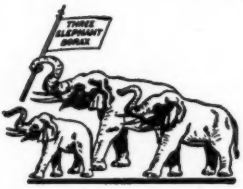
# Better Crops with PLANT FOOD

October 1945 10 Cents

The Pocket Book of Agriculture

# For Boron Deficiencies




## THREE ELEPHANT BORAX

WITH every growing season, more and more evidence of *boron* deficiency is identified. Crops where lack of this important secondary plant food is causing serious inroads on yield and quality include alfalfa, apples, beets, turnips, celery, and cauliflower.

THREE ELEPHANT BORAX will supply the needed boron. It can be obtained from:

American Cyanamid & Chemical Corp., Baltimore, Md.

Arnold Hoffman & Co., Providence, R. I., Philadelphia, Pa., Charlotte, N. C.

Braun Corporation, Los Angeles, Calif.

A. Daigger & Co., Chicago, Ill.

Detroit Soda Products Co., Wyandotte, Mich.

Dobson-Hicks Company, Nashville, Tenn.

Florida Agricultural Supply Co., Jacksonville and Orlando, Fla.

Hamblet & Hayes Co., Peabody, Mass.

Hercules Powder Company, Atlanta, Ga.

The O. Hommel Co., Pittsburgh, Pa.

Innis Speiden & Co., New York City and Gloversville, N. Y.

Kraft Chemical Co., Inc., Chicago, Ill.

W. B. Lawson, Inc., Cleveland, Ohio

Marble-Nye Co., Boston and Worcester, Mass.

Thompson Hayward Chemical Co., Kansas City, Mo., St. Louis, Mo., Houston, Tex., New Orleans, La., Memphis, Tenn., Minneapolis, Minn.

Wilson & Geo. Meyer & Co., San Francisco, Calif., Seattle, Wash.

Additional Stocks at Canton, Ohio, Norfolk, Va., and Wilmington, N. C.

Sears, Roebuck & Co. Stores

IN CANADA:

St. Lawrence Chemical Co., Ltd., Montreal, Que., Toronto, Ont.

*Information and Agricultural Boron References sent free on request. Write Direct to:*

## AMERICAN POTASH & CHEMICAL CORPORATION

**122 EAST 42nd ST. NEW YORK CITY**

*Pioneer Producers of Muriate of Potash in America*

# Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

*Editorial Office:* 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXIX NO. 8

TABLE OF CONTENTS, OCTOBER, 1945

Reform Wave Due 3
*And Jeff Is All for It*

More Vegetables for Less Money 6
*V. A. Tiedjens Explains How*

A Little Boron Boosts Sweet Potato Yields 11
*According to A. B. Bryan*

A Potash-Nitrate Relationship in Corn As Revealed by Tissue Tests 13
*Analyzed by A. C. Caldwell and J. M. MacGregor*

Hilding Hord—Dairyman 15
*G. R. Cobb Pays Tribute*

A Layout for Labor-saving 17
*Presented by Carlton Stoddard*

How to Start White Dutch Clover Pastures in Florida 18
*Discussed by R. E. Blaser*

Kudzu Responds to Potash 21
*R. Y. Bailey Has Found*

Soil Conservation—More Plant Food—Better Crops 25
*Advocated by W. M. Nixon*

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

**Member Companies:** American Potash & Chemical Corporation
Potash Company of America
United States Potash Company

*Washington Staff*

J. W. TURRENTINE, *President*
J. D. Romaine, *Chief Agronomist*
R. H. Stinchfield, *Publicity*
M. M. KEIM, *Economist*
Mrs. C. M. Schmidt, *Librarian*

*Branch Managers*

S. D. Gray, *Washington, D. C.*
H. B. Mann, *Atlanta, Ga.*
G. N. Hoffer, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
E. K. Hampson, *Hamilton, Ont.*

THE HUNTING SEASON IS HERE!

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1945, BY THE AMERICAN POTASH INSTITUTE, INC.

VOL. XXIX WASHINGTON, D. C., OCTOBER, 1945 No. 8

***War Goals Won . . . .***

# Reform Wave Due

Jeff McDermid

HAVING fought and won a big war in the interest of general reformation of the bewildered, bedeviled, and bewitched denizens of other lands, we have a little time now to manufacture a surplus of that precious commodity so that we in the homeland, no matter how remote, may partake of its benefits. Whether the Army, the Navy, the Air Force, or the Dons of Physical Engineering have won us the right to engage in wholesale reforming is beside the mark. At any rate reform was the gonfalon of war and the slogan of civilians hereabouts for five long years, although quiet chats with returning veterans do not exactly coincide with that theory behind the carnage. Having successfully ended the strife and begun the period of reconstruction and reform so long dangled before us as the ultimate goal, we might logically carry it over into the peacetime domestic scene.

Whether we can institute enough effective reform here at home without uprooting settled tradition and insulting too many privileged groups and individuals remains to be seen, or, maybe, to be fought out. We must ask ourselves if we can reform other folks and maintain peace in the family at the same time.

We Americans love change and excitement and we dote on targets and goals. I think we can safely depend upon the good old w. k. reformers and uplifters to inject enough of the old fire and fervor to give us all the glamour of wartime without quite so much personal risk, discomfort, and deprivation. Without some such aim in life we are going to bog down in the reaction, so I'm for a lively time of reform if it

doesn't interfere too much with my own habits and inclinations.

Argumentation is with us to stay, just like our eating habits, and this would indeed be a sorry place to live in if we had nothing but honey and salve set before us continually as food for mental digestion and spiritual metabolism. Some salt and pepper go well when used judiciously.

There are plenty of good folk who shy away from heated debates and fiery arguments and who do not believe in frank criticism, not even if it is directed squarely at the other fellow. But it isn't these little harmless safety-valve roadside arguments which breed deep-set festering troubles and cause cankers to form in the countryside. On the contrary, it's mostly what is *not* said out loud with fist-thumping and cussing that injures us most. The danger lies in things that are whispered and tabooed and QT'd and shied away from, that really sow the seed for dirty work at the crossroads, and sometimes end up in rebellions and civil splits.

Washing dirty linen in public has been decried and denounced repeatedly by conservative philosophers, who plead for peace and harmony, appeasement at all costs. However, I'd rather hang up a whole line of my neighbor's worst mistakes (or even mine) than to hide them in the cellar so long that the Board of Health finally sends a wagon over to take me and the laundry bag to the cleaners. In other words, scum rises to the top eventually, just as cream does, and if we wish to prevent that we've got to keep things stirred up.

NATURALLY a few of the more serious reforms facing us cannot easily be sorted and washed and ironed in these particular columns. They do not belong to me and I am not in the habit of drying duds on another man's clothesline. Besides, the problems involved are too complex for a brief essay and should be turned over to more pretentious social forums for threshing out. In this list are, of course, racial and capital-labor controversies. No man used to aiming an inoffensive air-gun should set himself up as master of the atomic bomb. This then settles that.

I hasten to pass on to a field where we can swap ideas on the sunny side of Main street and give nobody cause to infer that we are stepping on somebody's corns inadvisedly or without good and sufficient reason for advocating some porous plasters of reform.

Probably the first reform I shall undertake among my enthusiastic neighbors is to beg them not to hero-worship and glamorize the returned veterans. The basic fact in this reform hint is that they who saw the most murder and suffered the most terror and pain are usually the ones who want to talk about anything else but. They insist that they just did their duty like they were wont to do on any ordinary job. To others it was just another exciting game of athletics and skill, to be won and then forgotten. The sad thing about this glamorizing business is that it only lasts a few months and they know it. After that everyone melts back into civies, and rank and medals are no more. Grim competition and job-holding take its place.

IF we can get into a situation where we learn to glamorize humdrum, everyday routine production and steadfastness then we shall be honoring them all as well as ourselves and be making this a "safe country" to raise kids in for some time to come. We've got to find a way to make peace just as significant and heroic and stimulating to patriotism and good self-sacrificing citizenship as war and national peril.

Good old sensible Barney Baruch mentioned something like this about the returning veterans not long ago and his months spent talking with the boys on park benches bore fruit worth picking and preserving. Try your glamour on the "chair-borne" army and the draft-dodgers. They need it. The others don't.

Then take the home front next. During the war we learned to work together as a pretty good unit, with a few slackers here and there. Some of us served as block wardens and community drive

leaders, Red Cross boosters and aides, and donated blood and scrap metal and waste paper galore to the common pool. Most of us went through the strife with a little less steak than usual and a few less cigarettes and silk socks. We bore up well under all this strain and acquitted ourselves nobly. We forgot that we didn't like Jones and that Smith's church was not the right road to salvation, and that Boggs voted four times for Roosevelt.

So now we have withstood all that pressure and kept our tempers fairly well, except for a few Pro Bono Publicoes sent to the local palladium of liberty for local circulation, or maybe a fling or two in Rotary against some OPA injustice, etc. It occurs to me that maybe we ought to keep these relations intact as much as possible at least during the so-called reconversion epoch, and calm down our inclinations to raise Hades with the alderman and the grocer.

Or to put it quite another way, let's vow to gird our loins collectively rather than to put on private boxing gloves; and then keep on holding community confabs to cook up something pleasing in the general reform line that we can organize our war-built energy on to keep up steam for what's ahead.

It strikes me as a sheer pity to let all that drilled cooperation sink back into selfish back-yard privateering again. We talk about what Congress ought to do and doesn't ever accomplish, but remember it takes its cues and gets its charters to do or not to do right from the home front. The home front is still intact and should be the last to surrender its duties.

Of course we also need to reform ourselves in respect to the churches. (Nay, I am not entering any dangerous sector, so sit easy.) What I mean is that personally regardless of whose altar we worship at or whose hymns we sing out of tune, we need to keep this agency alive just as forcefully as we did during the war. In many barracks towns and camp sites you saw the kids in uniform assembling in church more regularly and with more serious mien than you ever witnessed previous to Pearl Harbor. Whether it was sentiment or religion that drew them that way is not for me to analyze. All I know is that here was a real common denominator that held something of spiritual worth when all the world was shaking. From here write your own ticket.

After we get all steamed up for genuine reforming with no holds barred or privileges given, let's tackle the next big public forum—the radio broadcasting gentry. Give us more power and less piffle on the networks. Let's find out what radio is really for—education and good entertainment or palaver and profits. If there was ever a case for exercising the power of public utility regulation thoughtfully and wisely, we face it now in handling broadcasting. My old friend, Paul Porter, of the Federal Communications Commission, thinks so, and he is thinking out loud too. In the end the radio people will thank us for their own emancipation, methinks.

WE have to do something in this line because startling innovations, including television itself, will soon appear on the everyday program of our networks; and we become either pawns or partners. Which way do you vote? Probably many of us will merely tune in on Crazy Water Crytsals or the Sink-scour Hour and let George do the reforming. And George will pass the buck to "Paul."

Having some first-hand experience in

(*Turn to page* 49)

# More Vegetables for Less Money

*By V. A. Tiedjens*

Virginia Truck Experiment Station, Norfolk, Virginia

THE total acreage of truck crops including mint, white, and sweet potatoes grown in the United States in 1944 was in excess of 7,500,000.* Of this total, 17 per cent was located in the Northeastern States and 30 per cent in the Gulf and South Atlantic States. A large part of this acreage is on Coastal Plain soils. Except for isolated areas, the soils on which these crops are grown are predominantly acid, requiring large quantities of liming materials to produce maximum yields. Many of these soils have been farmed for years and have gone through several cycles of depletion and rejuvenation. They are, comparatively speaking, low in nitrogen, phosphoric acid, and potash. It is not surprising, therefore, that these same areas use almost 60 per cent of the fertilizer sold in the United States. A large part of this fertilizer is used in the production of vegetable crops. White and sweet potatoes, tomatoes, sweet corn, green peas, snap beans, watermelons, onions, cabbage, and spinach make up most of the vegetable acreage.

Much of the acreage devoted to vegetables in the Corn Belt and neighboring states also is highly acid but has a higher potential fertility than the Coastal Plain area. Neither the lime nor the fertilizer requirement is as high and more manure is available, since many vegetables in these sections are grown as cash crops on dairy farms.

The fertilizer requirement of most vegetable crops is measured in tons per acre, while field crops have requirements of less than 1,000 pounds. In the seaboard states, where the soil is potentially low in fertility and where intensive vegetable crop production is being practiced, it is not uncommon for growers to use 20 tons of barnyard manure, two tons of mixed fertilizer, and 500 to 1,500 pounds of nitrate of soda to grow three crops during the year. Celery growers have used up to three tons of fertilizer per acre in this area. This high fertilizer requirement is partly due to conditions which have developed in the soil, preventing the roots of crops from exploring the soil below the plowed furrow. Where this condition has been corrected, tremendous increases in yield have been obtained with much less fertilizer.

### Changing Conditions

Not so many years ago most vegetables were grown with animal manures and on a much less intensive scale. The increase in land values, taxes, and labor costs, the substitution of manure by chemicals, and the failure to use lime, have been the basis for many problems, since they intensified the use of the land without proper restoration between crops. The experiment stations have only recently begun to correct these problems, yet those few growers who have studied them and instituted corrections have harvested yields far and above their most optimistic expectations. A man who can grow more than 1,200 bushels of spinach on land where formerly he was glad to get 300 bushels hardly needs to

* Vegetables grown in the 19,000,000 Victory gardens are not included in this total. Assuming an average garden of 1,200 sq. ft., we have an additional 500,000 acres besides the farm gardens which were not included.

be convinced that he is on the right track. And when he grows the crop with the same amount of fertilizer and very little more help, he begins to wonder whether his father knew as much about farming as he had given him credit for in the past. These growers have taken an active interest in their experiment station and are willing to turn their farms over for further cooperative work. Unfortunately, for every one of these, there are nine who do not care and they are the ones who are responsible for our low average state yields.

Plowing-under animal manure with a good cover crop of clover is far different from placing an equivalent amount of "hot" fertilizer in the row, as far as the vegetable crop is concerned. Unfortunately, too few of us have appreciated what was taking place. We are trying to do with nitrogen, phosphorus, and potash in concentrated amounts what we formerly did with animal manure, a product that not only added the above three ingredients but also lime, trace elements, organic matter, and hormones. These were well distributed throughout the soil, so that at no time did the plant have to gorge itself with plant nutrients.

As more and more chemical fertilizer has been used to replace animal manures, changes in the soil which have resulted in decreased yields have been brought about. Soils have become depleted in lime and there has been a tendency for the roots of our crops to remain in the plowed layer of soil. Gradually we have seen erosion taking away our surface soil because rain-water would not penetrate rapidly enough. Our crops have suffered during dry spells because they had to depend on the eight-inch surface layer for their water instead of the three or four feet below to which the plant was entitled. Yields have decreased, and to halt this decline we have used more and more fertilizer with the result that our fertilizer placement problem has grown, and we actually are beginning to wonder whether we can maintain a much larger population in these United States.

Strange as it may seem, the correction of the problem is in our dooryards through the interaction of an inexpensive product—the millions of tons of limestone which only need to be pulverized and applied to the soil. The use of lime is not new nor are its effects on the soil new, but gradually it has disappeared from our soils and

**Asparagus growing on soil which received five tons of dolomitic limestone per acre.**

fertilizer residues have filled the void. We are back to where we started some 75 years ago to reclaim supposedly worn-out and badly eroded soil. This time, however, we must do it with fertilizer and lime because there isn't manure enough to go around. We don't want to make the same mistakes a second time. Fortunately, we have considerable evidence to keep us more or less on the right track.

If we recognize the problems, we should be in a position to offer remedies. Our big problem is to get water to penetrate the soil, and roots to penetrate the subsoil. Many of our soils that are well-drained are poorly aerated. Sensitive vegetable crop roots are not adapted to poorly aerated soils. We must eliminate temporary pond holes which are becoming more and more frequent along the Eastern Seaboard.

We are getting into trouble from fertilizer burning the roots because we have stepped up the quantity and built up concentrated residues which have interfered with the movement of water to the plant. As a result, growers are becoming convinced that irrigation is the only solution to the problem. It may be necessary in some instances, but its need has been greatly overemphasized. During any dry spell when crops need water, idle irrigation lines can be observed because the growers say they do more damage than good. This simply emphasizes the fact that we don't know enough about irrigation.* This is a serious problem, and if corrected our state average yields will be more than doubled.

Getting the most for the fertilizer that we apply on naturally acid soil is a serious problem about which we can do something. Not only is it necessary to maintain the proper balance between the nutrients in the soil, but we must add calcium and magnesium to sweeten the soil to the point where roots will function properly. This does not mean reducing the acidity only in the surface soil. The acidity must be corrected to considerable depths in the lower horizons. This holds true for all crops except white and sweet potatoes where the surface soil should remain below pH 5.5. There are very few acid soils growing vegetables containing sufficient calcium. Before we can expect to harvest maximum yields of vegetables which are suitable for human food, we must satisfy the lime requirement of the particular soil type. This may mean one, two, three, or even ten tons per acre. If pulverized limestone is used, comparatively large quantities can be applied in a given year to hasten the time when maximum yields may be expected. If hydrated lime is used, it must be applied in small quantities over a longer period because its use can quickly throw the nutrient balance out of line. If, as when growing potatoes, we must farm acid soils, we must be satisfied with the yields we get. In some cases this is not too serious on certain soil types, since approximately maximum yields can be grown under these conditions.

### Over-liming?

Many of our growers have used one ton of liming material to the acre and have become discouraged because they saw no appreciable response from the treatment. Growers have heard more about the dangers of over-liming than about the advantages. This has come about from the use of hydrated lime under certain circumstances. As a result, the grower hesitates to put on more than a ton to the acre. I have encouraged growers to apply on strips one, two, three, four, and five-ton per acre applications of pulverized limestone, and in many cases they have found that the only application that had any effect was the five-ton application. One grower who tried this covered his farm with the maximum application of five tons and got more yield from two crops of spinach than he formerly did from four. As a matter of fact, this yield was the highest I ever heard recorded. And when he dug down to

* I am speaking of irrigation in the sections where rainfall is adequate but badly distributed throughout the season.

**A tomato field after a heavy rain. Fields which permit this condition have subsoils too acid for good drainage and therefore good yields.**

see where the roots were, they were found in abundance at the three-foot level and still going down. The important observation was that the crop was grown with the same amount of fertilizer that was formerly used for four crops.

Crops whose roots go down to the three- and four-foot level do not suffer from ordinary dry weather. We grew 14 tons of tomatoes per acre on soil with no rainfall between the latter part of May and the first week in September. The roots on these plants went three feet deep. They seemed to get sufficient moisture even though the surface soil was dust dry.

Unless a grower is willing to satisfy the lime requirement of his soil, he cannot hope to get the most from his fertilizer. I am reminded of a tomato grower's experience. He seemed to have done everything wrong as far as most recommendations were concerned and yet he grew the second largest yield in the state. He planted late, he used over-grown plants which any other grower would have discarded, he used too little fertilizer, and paid little attention to cultural practices. However, on close investigation I found he had applied a ton of limestone each of the 17 previous years. The pH was above 7.0. The roots went down as far as we could dig. It is experiences such as these that convince me that the first consideration in preparing Coastal Plain soils for vegetable crops is to satisfy their lime requirement. For sweet and white potatoes the problem is more complicated. Lime must be placed in the subsoil, but the plowed layer must remain below pH 5.5. This involves special subsoil applicators which will be available in the near future.

There probably is no one best method of applying the fertilizer, although some placements have advantages over others. The fertilizer-placement problem becomes less serious as the lime requirement of the soil becomes satisfied. However, fertilizer must be so applied that it will not injure the roots of plants. Thus, any departure from the old method of applying the fertilizer in the row under the plants will result in increased yields because of the removal of the danger from injury. Yet, that does not mean maximum yields. We want to be in a position to use the

amount of fertilizer needed for maximum yields without injuring or interfering with the growth of the crop. There are so many fixed charges in growing an acre of vegetables that any additional yield we can get from using more fertilizer means clear profit. How that fertilizer is incorporated in the soil, assuming that the soil is properly limed, will determine how much the crop will use to advantage. As far as possible, when the fertilizer is mixed with the soil, we should have a physiological equilibrium, established soon after its application. This means that there must be no interference with the movement of water to the plant nor the free growth of the roots through the soil. Unfortunately, we cannot eliminate this entirely because we do not have available ingredients for making up the ideal fertilizer. The best of them will build up concentrations, but these can be minimized by proper placement of fertilizer to encourage deep root penetration.

If all the fertilizer can be applied in one operation, it means saving in labor and reduced costs. If this can be done and at the same time give good distribution with minimum injury to the crop, we will have accomplished much in fertilizer placement.

In surveys made in recent years on the tomato and sweet potato crops it was found that growers were using 11 different methods of applying fertilizer. Highest yields were obtained where most of the fertilizer was applied deeply in the soil. Each method supposedly had some advantages, but many had more disadvantages than advantages.

The methods could be grouped under two headings: those that distributed the fertilizer generally through the soil, such as broadcast applications before or after plowing and solution methods; and those that concentrated the fertilizer in localized areas, which included all band and row methods, sidedressing methods, and dry subsoil applications.

Since most of the fertilizer applied in the past has been by concentrated placement, these methods will be discussed first. The band method has come into use as a means of eliminating fertilizer injury to the roots, one of the objections to the row furrow method. In this method the field was marked and the fertilizer was applied in the furrows left by the marker. Then the soil was

(*Turn to page* 42)

**Sweet potatoes growing on soil where one ton of dolomitic limestone was placed in the subsoil under the rows.**

# A Little Boron Boosts Sweet Potato Yields

By A. B. Bryan

Clemson Agricultural College, Clemson, South Carolina

RECENT tests in the use of boron in fertilizers for sweet potatoes by the South Carolina Experiment Station have led to two conclusions of consequence.

First, sweet potatoes need boron in small quantities for satisfactory growth.

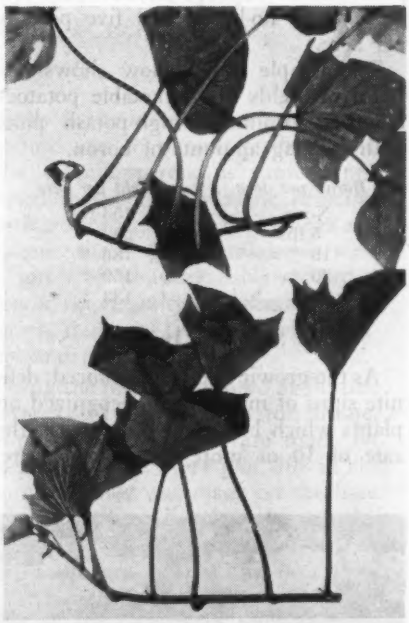
Second, sweet potatoes will tolerate only a small amount of boron and even a small excess of boron is injurious to the sweet potato plant and yields.

The South Carolina boron experiments, conducted at the Edisto branch of the State Experiment Station by Dr. C. J. Nusbaum, associate plant pathologist, were undertaken because of the general recognition of the economic importance of boron in fertilizer practice in connection with plant nutrition.

A summary of the tests by Dr. Nusbaum in 1944 shows that all possible combinations of three levels of lime (none, 1,500 pounds, and 3,000 pounds of dolomitic limestone broadcast per acre), three of potash (1,000 pounds each of 3-9-0, 3-9-6, and 3-9-12 per acre) and five of boron (none, 5, 10, 20, and 30 pounds of borax per acre) were compared and various interactions analyzed. The Porto Rico sweet potato was used, and the experiment comprised triplicate systematically arranged plots on a deep phase of intertile Norfolk sandy loam soil.

Throughout the growing season, frequent examination of foliage was made in order to detect symptoms of either injury or deficiency, and vine growth was measured twice.

At harvest, the yields of the various grades of sweet potatoes from each plot were recorded. These data have been summarized and statistical analysis is in progress. The sweet potatoes harvested from each plot are being kept separately in storage for further study.



**At top, boron-deficient plant showing curled petioles and stunted, distorted bud on plant suffering from boron deficiency. At bottom, normal plant.**

### Best Yields from Least Boron

Results at harvest time showed that best yields of sweet potatoes were from small quantities of boron in the fertilizer, five pounds of borax per acre. For such an increment of boron there was an increased yield of 40 to 70 per cent

above the yield from the no-borax plots in the test.

It is especially noteworthy and significant that as the amount was increased to 10, 20, and 30 pounds per acre, however, yields dropped sharply, the decrease being in proportion to the amount of borax applied. In general, yields from the 20- and 30-pound applications were about the same or slightly lower than those from the no-borax plots, and the yields from 10-pound applications were intermediate between those from no-borax and five pounds per acre.

The simple table below shows the trend of yields of marketable potatoes from the unlimed, high-potash plots with varying amounts of boron.

| *Borax per acre* | *Yield per acre* |
|---|---|
| None | 153 bu. |
| 5 lbs. | 253 " |
| 10 " | 186 " |
| 20 " | 159 " |
| 30 " | 133 " |

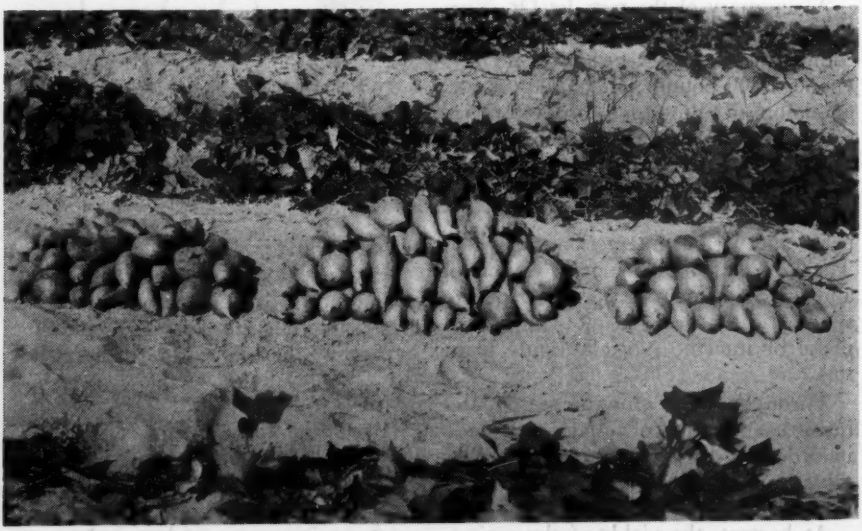
## Signs of Injury

As the growing season advanced, definite signs of injury were recognized on plants which had received borax at the rate of 10 or more pounds per acre. This injury was characterized at first by a bronze discoloration of the leaf areas between the veins and later by burning of the leaf margins. The symptoms usually appeared on the older leaves about four or five weeks after planting. In severe cases, the affected leaves were soon shed, leaving the stems near the crown of the plant exposed. Some of these naked stems showed evidence of slight sunburn. On injured plants, vine elongation was somewhat restricted although the tips of the vines appeared to be healthy.

Injury symptoms reached their peak about seven weeks after planting. Later on, however, most injured plants showed evidence of recovery and accelerated vine growth. Some plots, which received 10- and 20-pound applications of borax, showed severe injury in August. However, by harvest time, practically all signs of injury had disappeared. None of the plants on plots receiving no borax or the five pounds per acre showed any evidence of injury throughout the season.

Leaf and vine symptoms believed to be associated with boron deficiency were

(*Turn to page* 40)



**Effect of borax on yield of No. 1 sweet potatoes from three adjacent plots in the low-lime, high-potash series. Left, no borax; center, 5 lbs. per acre; right, 10 lbs. per acre.**

# A Potash-Nitrate Relationship In Corn As Revealed By Tissue Tests[1]

*By A. C. Caldwell and J. M. MacGregor*

Minnesota Agricultural Experiment Station, St. Paul, Minnesota

DURING the course of an investigation into the fertility status of some of the soils of southeastern Minnesota,[2] a series of plots was placed upon a soil that proved to be quite deficient in potash. The soil had been formed from three feet of glacial drift over a bed of limestone and is a Rockton silt loam, with a dark-colored surface soil shading to yellow brown at lower depths, the subsoil terminating in a bed of limestone at three feet.

The field on which the plots were placed has been cropped for a long time. The more recent cropping history was soybeans in 1943, preceded by three years of alfalfa, the last crop of alfalfa having been turned under. No commercial fertilizer or lime had been applied to the field for many years. The pH of the 0-6 inch depth was 5.0 and of the 6-12 inch depth 5.1.

The primary object of the study was to determine the fertilizer ratio which would give the most economical returns when applied to corn. To do this a factorial type of experiment was set up, in which nitrogen, phosphate, and potash were applied at three levels, 0, 1, and 2 in all possible combinations. This meant an application of 27 different fertilizer formulae, and each treatment was replicated four times, (A, B, C, and D in the table).

Early in the season the major growth response was to phosphate, but it became quite apparent as growth progressed that potash was the principal limiting element. With deficiencies and responses showing up remarkably well, the series of plots available offered a splendid opportunity to observe the correlation, if any, of tissue test with treatment and plant response.

Using the methods devised at Purdue University (1), tissue tests for nitrate, phosphate, and potash were made on some plants from every plot, 108 in all. The nitrate test was made on the base of the stalk, the phosphate test on the tassel stalk, and the potash test on the base of the leaf nearest the ear. The results for phosphate are not shown in the table, but almost without exception the test showed low to very low, regardless of treatment. The tissue tests were made early in September and it may be that phosphate had moved out of the tassel stalk and that organ was no longer a sufficiently sensitive phosphate indicator. Since nearly all phosphate tests showed low, there could be no relationship shown between phosphate content and treatment, or phosphate content with nitrate and potash.

The nitrate and potash, however, showed a very interesting relationship, as can be observed from the table.

[1] Paper No. 2236 of the Scientific Journal Series, Minnesota Agricultural Experiment Station.

[2] This investigation was suggested and is supported financially by the Hormel Institute, Austin, Minnesota.

(1) Thornton, S. F., Conner, S. D., and Fraser, R. R., *The use of rapid chemical tests on soils and plants as aids in determining fertilizer needs.* Ind. Ag. Exp. Sta. Circ. 204 (revised). 1939.

If plots 1, 2, and 3 are considered first, it will be noticed that the fertilizer treatments did not contain nitrogen or potash. The tissue tests showed nitrate to be low in all cases. The potash tests were variable, but generally speaking, were on the low side. It would appear, from the evidence at hand, that these plants suffered from a deficiency of both nitrogen and potassium, and the former despite the fact that the land had grown legume crops the four years preceding the corn crop.

Plots 4 to 9 had potash applied at two rates, 32 and 64 pounds of $K_2O$ per acre in the hill. An entirely different picture is presented now by the potash tests, which are predominantly high to very high. An abundance of potash available in the soil was reflected by an abundance in the plant, and the tissue test demonstrated it quite conclusively. Plots 4 to 9 had no nitrogen applied whatsoever, the only source being what was in the soil, yet surprisingly enough, the tissue tests indicated a good supply of nitrogen as nitrate in the plants. It would appear that an application of potash increased the potash content of the plant, and associated with this, there was an increase in the nitrate content.

Plots 10, 11, 12, 19, 20, and 21 had no potash applied but did get 16 and 32 pounds of nitrogen per acre, respectively, applied in the hill. The nitrogen was applied as ammonium sulfate at time of planting. The application was made only a few inches under the surface, and it is probable that the nitrogen had been converted to the nitrate form long before the tissue tests were made late in the summer. It would be reasonable to suppose that after applications of nitrogen as heavy as the above there would be an abundant supply of nitrate nitrogen in the plant, but it could not be detected by the tissue test. As was found in plots 1, 2, and 3, where no potash was applied, the potash test in plots 10 to 12 and 19 to 21 showed low as well and once more was accompanied by a low nitrate test.

It would appear that under the con-

(*Turn to page* 41)

| Plot No. | Treatment[1] | Nitrate | | | | Potash | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | *A* | *B* | *C* | *D* | *A* | *B* | *C* | *D* |
| 1 | $N_0P_0K_0$ | L[2] | L | VL | L | L | M | M | M |
| 2 | $N_0P_1K_0$ | L | L | L | VL | M | L | M | L |
| 3 | $N_0P_2K_0$ | L | L | L | L | L | H | L | L |
| 4 | $N_0P_0K_1$ | M | M | M | L | H | L | H | H |
| 5 | $N_0P_0K_2$ | H | H | M | H | VH | H | VH | VH |
| 6 | $N_0P_1K_1$ | M | M | H | M | H | VH | VH | H |
| 7 | $N_0P_2K_1$ | H | M | H | M | VH | M | M | H |
| 8 | $N_0P_1K_2$ | H | H | M | M | H | H | VH | H |
| 9 | $N_0P_2K_2$ | H | H | M | H | H | H | H | H |
| 10 | $N_1P_0K_0$ | L | L | L | L | L | M | L | L |
| 11 | $N_1P_1K_0$ | L | L | L | VL | L | L | L | L |
| 12 | $N_1P_2K_0$ | L | M | L | VL | L | L | L | L |
| 19 | $N_2P_0K_0$ | L | L | L | L | M | L | L | L |
| 20 | $N_2P_1K_0$ | L | M | M | L | L | L | M | M |
| 21 | $N_2P_2K_0$ | M | L | L | L | L | L | L | M |

[1] $N_0P_0K_0$ = no fertilizer
$N_1$ = nitrogen at 16 pounds per acre in the hill
$N_2$ = nitrogen at 32 pounds per acre in the hill
$P_1$ = phosphorus at 32 pounds $P_2O_5$ per acre in the hill
$P_2$ = phosphorus at 64 pounds $P_2O_5$ per acre in the hill
$K_1$ = potash at 32 pounds $K_2O$ per acre in the hill
$K_2$ = potash at 64 pounds $K_2O$ per acre in the hill

[2] L = low
M = medium
H = high
VH = very high
VL = very low

# Hilding Hord — Dairyman

*By G. R. Cobb*

Salisbury, Maryland

First "tie-up" underneath an abandoned bridge or culvert.

MANY young men of today are prone to bewail the fact that there are not as many opportunities for success in business as there were in the olden days. Among the many illustrations which can be cited to disprove this idea is that of Hilding Hord of Marston's Mills, Massachusetts, who was confronted with many obstacles in his path to being a successful dairyman.

Mr. Hord was born in Sweden and early in life learned the stone-cutter's trade. For eight years after coming to America he pursued the trade, but as time passed he realized that he could not satisfy his desire to become a violinist unless he changed his vocation, and so he accepted a position as butler with a prominent family in the Back Bay section of Boston—at that time one of the most exclusive residential areas in the State. In his new position he found time to take lessons at the Conservatory of Music and also time to practice.

The urge for a "piece of land" became so strong that after five years as a butler Mr. Hord resigned and bought a farm on Cape Cod. There was practically no cleared land on this 92-acre farm nor buildings. The first "tie-up" for his one cow was an old abandoned bridge or culvert on the farm, the floor of the bridge serving as a roof. Since that day when he bought the place, about 24 years ago, all the land has been cleared and seeded to grasses and clover or corn, and the "bridge barn" has been replaced by a group of the most modern farm buildings.

A "city slicker," Mr. Hord knew nothing about milking a cow, and so the first cow was milked by Mrs. Hord until he learned the art. This first cow was purchased to supply the family with milk. Being a good producer, she soon provided more milk than the Hord family could use. Some was sold to a neighbor, and due to a lack of horse or wagon, the milk was delivered by Mr. Hord on a bicycle. The bicycle delivery has been replaced by six trucks with removable bodies, each body being supplied with "tracks" on which the cases of milk can be slid into the truck or removed. When a body is worn out or becomes rather the worse for wear, it can be removed and a new body placed on the same chassis. Each body is kept well painted with the name of the farm, Mystic Lake Farm, and telephone number on each side.

The one cow dairy has now grown to 100 milking animals and from 35 to 40 head of young stock which are used as replacements. In order to house this large herd Mr. Hord has erected sev-

eral air-conditioned barns where the cows are stanchioned and other barns for the young stock. A modern milk-room with the most up-to-date bottling machines and other necessary equipment is also part of the farm buildings. The few quarts a day delivered when he first started operations have now grown to 1,500 quarts daily, and Mr. Hord's operations are the envy of some of the larger milk dealers. Needless to say, he has been offered a substantial sum for his business, but thus far all offers have been refused.

### Procedure After Clearing

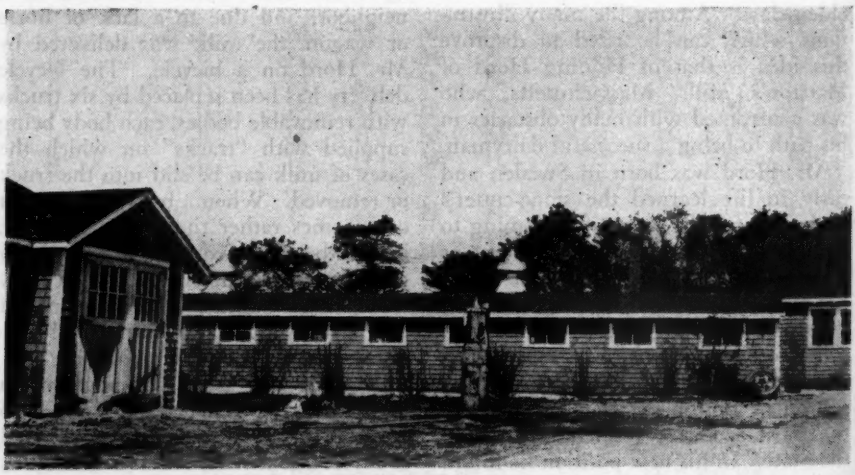
Mr. Hord discovered early in his career on the farm that if stumps were cut off level with the ground they rotted in three or four years and even sooner when the stumps were of the soft woods. After the land has been cleared it is seeded to oats or oats and Ladino clover. The oats may be pastured, put into the silos, or cut for hay. Incidentally, the two 140-ton silos on the farm were demolished in the September 1944 hurricane. When the oats are removed, the Ladino clover produces an excellent pasture for several years. Winter wheat is seeded after corn. Mr. Hord does not raise much hay on his farm as he believes that land devoted to good pastures will return more than the same land seeded to hay. Most of the hay used is purchased.

Rotational grazing is practiced on Mystic Lake Farm where there are 10 paddocks of about 4 acres each seeded to pasture grasses with Ladino clover predominating. The cows are turned into these paddocks for two hours each day and even this large number of cows is unable to keep the grass down and it must be mown frequently.

As the main object is the production of milk, Mr. Hord does not devote much of his time to breeding work; but since he is an excellent judge of cows, all of those he buys must come up to a certain standard. The most important consideration is the udder, which must pass close scrutiny before the cow is accepted, and the cow must be rugged with that well-known wedge shape so desirable in a milking animal. The herd is of mixed blood, being mainly of the Guernsey breed, but there are also animals of Holstein origin as well as of Ayshire blood.

In addition to the 92 acres on his own farm, he rents 50 acres from a neighbor, most of which is used as a pasture. The state road divides this rented land from the home farm and the State Road Commission, when building the road, provided a passageway from the farm

(*Turn to page* 45)



**The original "bridge barn" has been replaced by modern farm buildings such as these.**

# A Layout for Labor-Saving

*By Carlton Stoddard*

(Reprinted from Successful Farming, July 1945)

WILLIAM RENK and his three sons have remodeled their barns around their tractors—and by so doing have furnished farmers and "efficiency experts" alike with a good deal to talk about. For the Renk livestock system completes the circle of growing the crop, harvesting it, feeding it, and returning it to the land as manure with surprisingly few man hours spent on the job.

Kindly, keen-eyed William F. Renk of Sun Prairie, Wisconsin, is a hybrid seed grower, stockman, and premier Shropshire breeder of the nation. His sons, Walter, Wilbur, and Robert, are of the same mold; all four concentrate on outsmarting the pitchfork and scoop shovel.

Wisconsin was rocked back on its heels this year when the Renk farms tallied over a million pounds of steers, hogs, and sheep sold on the hoof—12 months' output from 850 acres. That plus 25,000 bushels of hybrid seed corn, 10,000 bushels of Vicland oats, and a carload of sheared wool added up to an 86-car trainload of produce—several hours' supply for our men on *all* fighting fronts.

There are some angles to Renks' tractorized feeding plants that have made veteran feeders stop and look twice to see what's going on.

Each of five such farm plants, built so a tractor can be driven inside for both feed and manure handling, has been reduced to a one-man setup. One man manages 350 hogs, 100 steers, and 45 sheep. And he does it in eight hours of light chores a day from about December to April. From then until snow flies he is free for field work while animals tend themselves on pasture and help themselves to every fourth (male) row of hybrid seed corn left in the stalk.

"Mechanized barn" may suggest a farm factory rumbling with driveshafts, pulleys, and conveyor belts. On the contrary, there is not even an elevator to get out of whack.

### The Principle

The Renk principle is simply this: arrange your barn on two floors, with a ramp leading up to the second story so a tractor and wagon can be driven into a large, feed-storage room. That elevates your feed high enough so it can be distributed to the lower floor by gravity. (With chopped and baled hay foreshadowing smaller haymows, thousands of existing haymow driveways could be remodeled and enlarged to provide such a feed storage and grinding room.)

Hay slides out easily thru a chute to the cattle-yard feed rack. Ground feed drops thru a trap door to self-feeders for hogs quartered on the lower floor of the former dairy barn. The most unusual feature is Walter Renk's postwar plan for a swinging-boom carrier track from silo to cattle feed bunks. They will be arranged in a half-circle or arc matching that of the boom.

All winter I waited for the opportune moment to get a picture story of the final step in the Renk cycle. One balmy spring day when the fields were drying fast and the manure spreaders

(*Turn to page* 47)

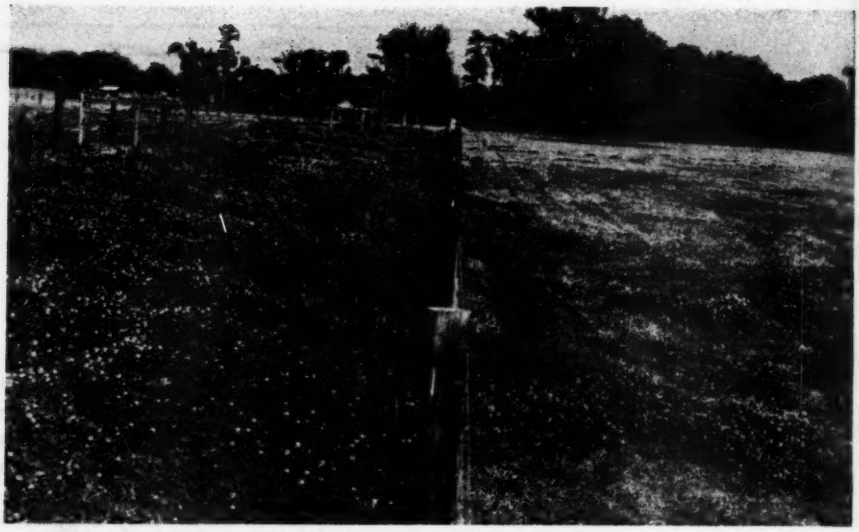


**Fig. 1. Sods grazed closely in the fall encourage rapid seedling growth, thus earliness and productivity of clover pasture—left. Clovers grew slowly on the grass sod which was not grazed closely—right.**

# How to Start White Dutch Clover Pastures In Florida

*By R. E. Blaser*

Florida Agricultural Experiment Station, Gainesville, Florida

PASTURE mixtures of grasses and clovers are greatly superior to pastures in pure grass stands. This is true because of four primary reasons. The quality of herbage is improved because clovers are higher than grasses in minerals such as phosphorus and calcium and in protein content. Secondly, clovers increase the amount of pasture herbage because leguminous plants which are properly nodulated and grown under a favorable environment fix nitrogen to stimulate growth of the host leguminous plant. Clovers also add much nitrogen to the soil, which increases growth and quality of grass herbage. Certain pasture legumes such as White Dutch clover are particularly desirable because they furnish herbage in early season when grasses are dormant. Pastures with grasses and clovers may be maintained in a highly productive condition at lower costs than grasses grown alone. This is true because nitrogen is the primary growth-promoting element that is needed for productive grass growth, and this element is especially deficient in the Coastal Plain soils. Nitrogen fertilization is rather expensive because of the actual cost of the element and also because it does not accumulate in

soils due to leaching in humid areas.

Certain factors which effect the success of growing clover-grass pastures should be carefully considered. White Dutch clover is the most commonly used clover in Florida and the South. It is adapted only to soils with very favorable moisture as this clover does not root deeply. Soils with high water levels and relatively high in colloids or organic matter are especially desirable. This clover is planted in the fall from October to December. Seedlings from volunteer seed also start their growth during the fall season. The fall and winter season is often the driest season of the year, therefore soils to be established with White Dutch clover should be carefully chosen so as to have a good moisture supply during seedling development.

White Dutch clover thrives only under high fertility levels. Coastal Plain soils in Florida require 1 to 2 tons of calcic or dolomitic limestone per acre. A soil reaction ranging from pH 5.5 to 6.0 is suitable. Phosphorus and potash applied at the rate of 500 to 600 pounds 0-10-10 or 0-14-10 are generally sufficient for soils which have not been fertilized previously.

Strains of White Dutch clover differ greatly in adaptation; seed produced in Louisiana, Mississippi, or similar areas grow best in Florida. Seed from northern states and foreign lands have given inferior growth and fail to seed and volunteer satisfactorily. Two to five pounds of seed per acre give good stands provided the seed is inoculated heavily (10 times the rate recommended by manufacturers of the inoculent) and if the soil moisture is favorable.

Clovers may be seeded in Florida any time between October and January. Seedings made during a period of favorable soil moisture and rainfall are most apt to be successful. Many clover pastures in Florida have been planted during a rain, as this aids rapid germination and nodulation. Inferior nodulation often occurs when the seed is sown during dry spells.

White Dutch clover may be planted on newly prepared seedbeds not yet planted to grass or on established grass pastures. Good clover seedbeds should be firm or packed and free of tall competing vegetation. When making plantings on newly prepared seedbeds

**Fig. 2. First season's growth of a clover pasture. Lime and fertilizer were surface broadcast on an established grass pasture and inoculated seed was sown during a rainy period. Donegon Dairy at Largo, Florida.**

it is desirable to prepare the seedbed well in advance of planting time to allow time for rains to pack the soil to establish capillarity. Sandy soils of the Coastal Plain area do not pack well immediately after disking or plowing. Rolling immediately after planting to firm the soil and cover seed is beneficial.

If clovers are to be seeded on established grass pastures, the lime and fertilizers may be surface broadcast in advance of clover planting time. Cattle may be concentrated on grass pastures to be established with clovers to graze the grass closely. It is not possible to mow dense growing sods close enough, thus grazing animals are necessary to eliminate competition, Figure 1. Clover seeds germinate early in fall on closely grazed sods because soil temperatures are reduced which breaks the hardness of seed coats. The seedlings grow rapidly when the sods are grazed closely because there is less competition. Clover seedlings in dense sods develop elongated hypocotyls. This is objectionable as seedlings in this condition are cut off below the bud when grazed and thereby exterminated. A soft and spongy texture of sods is not desirable for clover seedlings.

The inoculated seed is surface broadcast without disturbing the soil when soil moisture is favorable for quick germination. This method of planting clovers on established grass pastures without soil preparation is most generally used by Florida farmers, Figure 2. Light disking or harrowing is desirable for seed coverage in case of unfavorable weather.

Many farmers have been hesitant to plant clover pastures because of the rather high cost of seed, fertilizer, lime, and soil preparation. These costs are often more than the value of the land.

White Dutch clover has been established successfully by burning off the wiregrass vegetation and saving the cost of plowing or disking. B. F. Williamson, Gainesville, Florida, and B. H. Carlton, Jacksonville, Florida, have established clovers with less costly techniques. Both men are establishing clover-grass pastures without soil preparation. Mr. Williamson applies lime obtained from a local quarry, chops the vegetation with a rotary chopper and burns over the native vegetation (wiregrass, palmetto, and gallberry), after which 0-14-10 fertilizer is applied,

(*Turn to page* 45)

**Fig. 3. Establishing clover on cut-over pine land. The native vegetation was cut with a rotary chopper and burned over and then limed, fertilized, and seeded.**

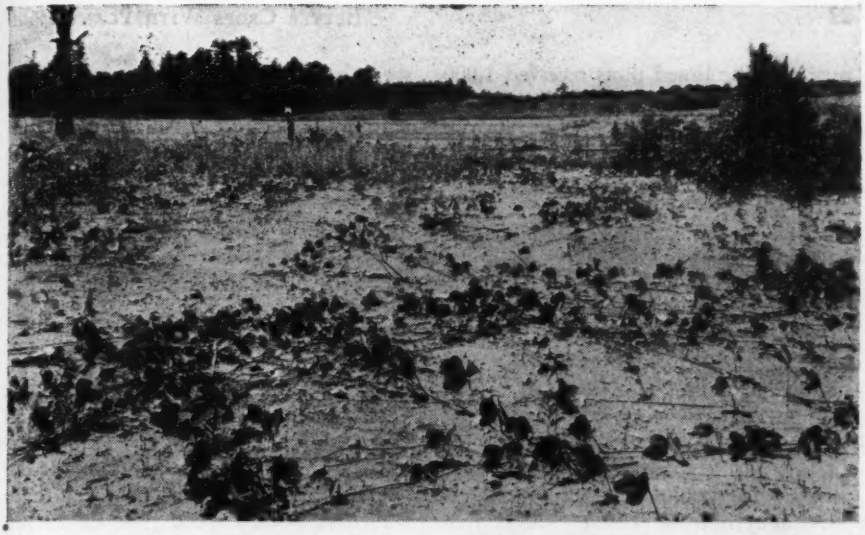


Fig. 1. Kudzu that was planted in severely eroded Madison clay without fertilizer near Dudleyville, Alabama, in 1935 did not cover the ground when photographed June 6, 1939.

# Kudzu Responds to Potash

*By R. Y. Bailey*

Regional Agronomy Division, Soil Conservation Service, Spartanburg, S. C.

THE growing popularity of kudzu for soil conservation has caused this crop to be taken into many sections where little was known about its fertilizer requirements. Results of fertilizer experiments, field trials, and demonstrations at several places in the South showed that it responded well to phosphate. Evidence is accumulating that on many soils potash must be included in fertilizers for kudzu.

On the clay soils of the Piedmont Plateau where most of the earlier demonstration projects of the Soil Conservation Service were located, phosphate caused a visible increase in the growth of kudzu. Most of these soils had enough available potash to supply the crop's immediate needs.

On the sandy soils of the Coastal Plains, phosphate alone often resulted in satisfactory growth during the first few years after planting. In other cases, growth was poor where phosphate alone was used. Older plantings in both the Piedmont and the Coastal Plains often developed signs of potash hunger after being harvested for hay one or more years.

Fertilizer studies conducted by R. D. Lewis and J. H. Hunter of the Bureau of Plant Industry showed that kudzu responded to a complete fertilizer, to lime, and to a combination of lime and complete fertilizer on Greenville sandy loam and on Norfolk sandy loam. These sandy soils had a reaction of approximately pH 5.8 before the experiment was started. The fertilized plots received 400 pounds of 4-8-4 an-

nually. The limed plots received 1,000 pounds of limestone per acre in 1935 and 1,000 pounds in 1936. On Norfolk soil, an additional 500 pounds were applied in 1938.

### Average Yields

Four-year average yields of green kudzu from the different treatments on Greenville sandy loam were: Fertilizer, 11,217; fertilizer and lime, 14,092; no fertilizer, 9,670; and lime alone, 9,028 pounds per acre. On Norfolk sandy loam the yields of green kudzu were: Fertilizer, 10,275; fertilizer and lime, 10,574; no fertilizer, 4,530; and lime alone, 5,423 pounds per acre.

Although these results show that kudzu responded to complete fertilizer, it is not possible to tell which element was most effective. Fertilizer results at other places would indicate that most of the increased growth on these sandy soils was due to phosphate and potash. Nitrogen reduced the yield of kudzu on clay soils near Anniston, Alabama. This reduction in yield appeared to be due to the increased growth of weeds following the application of nitrate of soda. Increases due to lime were much less than those from fertilizer.

In a cooperative fertilizer trial conducted by the Soil Conservation Service and the Alabama Agricultural Experiment Station, kudzu responded markedly to applications of basic slag. This fertilizer trial was established in March 1939 on kudzu that was planted in the spring of 1935 as a part of the extensive soil conservation demonstration in the Dadeville project area.

The kudzu, which was planted on very severely eroded Madison clay, had not made by the end of the 1938 growing season sufficient growth to cover the ground. The soil was so poor that there was not enough weed growth during the first 4 years to compete with the kudzu plants for moisture.

Plots were laid out in triplicate for treatment. In addition to fertilizer treatment, no cultivation, partial cultivation, and complete cultivation were compared. Basic slag was applied at rates of 400, 800, and 1,600 pounds per acre. No other fertilizer was used in this experiment.

E. C. Richardson of the Soil Conservation Service research staff reported

**Fig. 2. The Kudzu shown in Fig. 1 still had not covered the ground when this photograph was made August 25, 1942. The poor soil did not even support enough weeds to blanket the ground.**

**Fig. 3. The kudzu shown here looked like that in Figs. 1 and 2 before 1,600 lbs. of basic slag per acre were applied in March 1939. Photographed August 25, 1942.**

the yields of kudzu from the different treatments for the 3-year period, 1940-1942, inclusive. Since the differences in yields due to cultivation were not particularly significant, only the results on the uncultivated series of plots are given.

Average annual yields for the different treatments were: Unfertilized, 1,744; 400 pounds basic slag, 2,652; 800 basic slag, 10,246; and 1,600 basic slag per acre, 14,388 pounds of green kudzu per acre. Results elsewhere from the use of superphosphate would indicate that the phosphate rather than the lime in basic slag was responsible for most of the increased growth of kudzu.

### Response to Fertilizer

It is interesting that on the very poor site where this kudzu was growing, a light application of 400 pounds of basic slag per acre was not enough to stimulate vigorous growth. A moderate application of 800 pounds resulted in a fairly dense growth, whereas, a heavy application of 1,600 pounds gave a substantial increase over the 800-pound application. This indicates that on some of the severely eroded soils where kudzu is being planted, sufficient initial phosphate to furnish the equivalent of around 100 pounds of phosphoric acid per acre may be necessary to get satisfactory growth of kudzu or other perennial vegetation.

Kudzu on sandy soils at the North Florida Agricultural Experiment Station, Quincy, Florida, responded to both phosphate and potash. In reporting on the results of fertilizer work there, J. D. Warner, Vice Director in charge, said: "A kudzu fertilizer experiment on the North Florida Experiment Station shows clearly the need for phosphate and potash. In this experiment, the need for potash did not show up until the fourth year of the experiment. During the fourth and fifth years an acute shortage of potash was evident, particularly where phosphate only was applied. On this plot phosphate appeared to accentuate the potash deficiency.

"It now appears that annual applications of 300 to 400 pounds of superphosphate and 100 to 150 pounds of muriate of potash will be required for maximum growth and maintenance of stands of kudzu on most soils in this area. Observations of kudzu in this area also convince me that annual applications of fertilizer

as mentioned above will be required.

"To date, we have no results to show the necessity for lime on kudzu. Lime response may possibly show up as the experiment grows in age."

Simple fertilizer demonstrations on several of the sandy soils of Mississsippi gave indications of fertilizer response in 1944. These demonstrations were conducted in soil conservation districts. Personnel of the Soil Conservation Service assisted farmers in setting up the demonstrations and in taking yield records. In several districts county agricultural agents cooperated in conducting the demonstrations. Like most demonstrations of the kind, much information is lacking about previous treatment of the different sites used. Results represent interesting trends but cannot be interpreted closely.

In 10 of these demonstrations, kudzu on which 200 pounds of 25 per cent manure salts were applied was compared with adjoining untreated kudzu. The kudzu that was untreated made an average yield of green forage of 12,969 pounds per acre, whereas that which received 200 pounds of manure salts per acre made an average yield of 17,353 pounds.

### Response to Phosphate

In another series of 6 simple demonstrations, kudzu with 200 to 300 pounds of superphosphate per acre was compared with adjoining areas of kudzu on which 200 pounds of manure salts per acre were applied, in addition to the phosphate. The kudzu which received phosphate alone made an average yield of 13,474 pounds as compared with 19,393 pounds of green forage per acre where both phosphate and potash were applied.

The low returns from the use of phosphate may have been due to previous applications of phosphate which were not reported in the history of the treatment of the areas on which the demonstrations were established. Since it has been rather common practice to fertilize legumes with phosphate, it is probable that phosphate had been applied on several of the areas prior to 1944. This may account for the relatively higher increase from potash than that from phosphate.

In only two cases did the application of potash fail to give an increase in the yield of green kudzu. In one of the demonstrations on Pheba (very fine sandy loam) the untreated area produced 18,710 pounds as compared with 13,936 pounds of green kudzu where 200 pounds of manure salts were applied. In another demonstration on Paden soil, yields with and without potash were the same.

### Response to Potash

Although these results are not conclusive, they show that kudzu needs potash on the sandy soils where the demonstrations were conducted. Results of these demonstrations and the results reported from Quincy, Florida, by Mr. Warner indicate that on soils where cotton requires a complete fertilizer, kudzu will respond to both phosphate and potash.

As further evidence that potash deficiencies may develop after a few years' use of kudzu or sericea lespedeza, old plantings of both crops that grew vigorously the first few years after planting with phosphate alone deteriorated after being used for hay or pasture for a few years. Corn following several years of sericea lespedeza from which several crops of hay were harvested has shown pronounced potash hunger, even though the sericea grew vigorously without potash fertilizer.

Thus the evidence accumulates that kudzu and sericea, hardy, deep-rooted perennials that have made remarkable growth during the first few years on poor soils, are not going to be miracle plants. They will require much the same fertilizer as other legumes that are harvested for hay or used for pasture. This suggests the importance of fertilizing these crops from the beginning, rather than waiting for hunger signs to develop.

**At Marshall, Texas, after clearing, this land was seeded to a mixture of white Dutch clover, yellow hop, lespedeza, and Dallis grass. Approximately 120 acres are now well established and milk production has increased about 30 per cent since the stock has had access to abundant clover.**

# Soil Conservation More Plant Food Better Crops

*By W. M. Nixon*

Soil Conservation Service, Fort Worth, Texas

SINCE 1939 farm owners and operators of the United States have organized more than 1,200 operating soil conservation districts, including about one-half the farmers of the nation. Two hundred and forty-seven districts have been organized in Oklahoma, Arkansas, Louisiana, and Texas covering almost 70 per cent of the total land area of those four states. The primary impetus behind this nation-wide soil conservation movement has been the knowledge that millions of acres of fertile topsoil are being lost annually through soil erosion. The topsoil, a thin layer averaging only about six or seven inches in depth, contains the major portion of organic matter and available plant food essential to crop production.

The soil conservation districts, through their farmer-cooperators and with the technical assistance of the Soil Conservation Service, are planning, applying, and maintaining complete soil conservation programs which include: (1) proper land use; (2) the right combination of conservation practices; (3) the maintenance and improvement of soil productivity; and (4) economically sound conservation farming.

A conservation cropping system is one of the major practices of a complete

soil conservation program. A conservation cropping system is one that helps minimize soil losses and aids in maintaining and improving soil productivity. To achieve this objective the cropping system should include the use of annual and perennial legumes and grasses in combination with clean-tilled or row crops. The legumes and grasses, most of which are planted broadcast or in close rows, provide protection against soil loss and add organic matter to the soil.

### An Effective Cropping System

A conservation crop rotation which has proved effective in conserving the soil and increasing its productivity in the rolling, sandy land area of East Texas, Louisiana, South Arkansas, and Southeastern Oklahoma, is:

First year—corn and summer legumes, followed by vetch or other winter legume in the fall, worked into the soil in the spring;

Second year—cotton, followed by small grain in the fall;

Third year—cowpeas or other summer legume, with the crop residue left on the surface or worked into the soil.

A cropping system such as this is a big improvement over that of alternate cotton and corn, or straight cotton, which leads to soil loss and soil depletion. When the organic matter is depleted, not only does production decrease, but the soil erodes more rapidly.

Farmers have found that the use of a conservation crop rotation, in combination with such conservation practices as contour tillage, terracing, and proper use of crop residue, results in from 30 to 50 per cent increases in crop yields.

Satisfactory growth of cover and soil-improving crops, as well as cash crops, depends to a large degree on the application of the necessary soil amendments such as potash, phosphorus, nitrogen, and lime.

Soils which have been cultivated for any length of time in the high rainfall area are usually deficient in one or all of these elements.

Legumes are heavy feeders on potassium and phosphorus, and in order to obtain maximum production, these elements should be added. Many farmers are just beginning to realize the importance of applying potash in addition to phosphorus to legumes and grasses being used for cover and soil improvement, and for pasture or meadow.

Soil conservation district cooperators in East Texas and North Louisiana have reported that muriate of potash added to white Dutch clover, hop clover, lespedeza, Dallis grass, and Bermuda grass pastures has resulted in earlier spring grazing, a longer grazing period, more ready grazing of vegetation by livestock, and greater resistance to drought; also that yields of common lespedeza, perennial lespedeza, and kudzu have been increased from one-fourth to one-half ton of forage per acre.

Comparable increases in amounts of vegetative production have been secured with such winter legumes as vetch and Austrian winter peas. This increase in vegetative growth not only is profitable from a production standpoint but affords better protection against soil loss and depletion.

From 300 to 400 pounds of 0-12-12, 0-14-10, or 0-14-7 are good fertilizers to use on many legumes on sandy soils. Where the soils are badly eroded and depleted, a complete fertilizer should be used.

Legumes, when properly inoculated and turned under as soil-improving crops, add nitrogen to the soil for use by crops that follow in the rotation.

Farmers should have soils analyzed wherever this facility is available, and base their fertilizer applications on the needs as indicated by the analyses.

Establishing and maintaining improved pastures are other major soil and moisture conservation practices. Soil and moisture losses from pastures containing a good cover of grasses and clover are insignificant.

The development of an improved pasture involves many practices such as land preparation, seeding or sodding, fertilizing and liming, cultivation, mowing, proper stocking, and providing an adequate water supply.

(*Turn to page* 48)

**Above: At Bernice, Louisiana, vetch and fertilizer increased the yield of corn on the cahaba very fine sandy loam of a field cleared before the Civil War from 12 to 43 bu. per acre.**

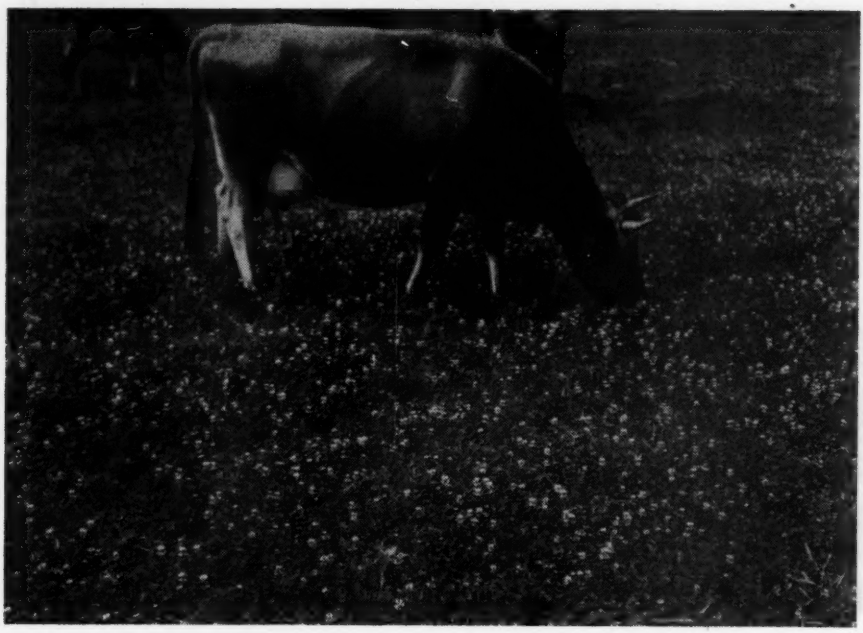
**Below: At Paragould, Arkansas, red clover and fertilizer resulted in a yield of 80 bu. of oats per acre and an estimated 65-bu. per-acre yield of corn, left. Right: no fertilizer or cover crop.**

**Above: At Okmulgee, Oklahoma, crotalaria grown three years on deep sandy soil resulted in an increased production of corn from 19 to 44 bu. per acre.**

**Below: At Mt. Pleasant, Texas, this grower is disking under vetch on contour following peanuts.**

**Above: At Elkhart, Texas, the cotton at left followed vetch in a 3-yr. rotation of corn, vetch, and cotton. The cotton at the right followed cotton.**

**Below: At Mt. Pleasant, Texas, this land should be retired to a permanent cover.**



**Above: At Kentwood, Louisiana, this pasture improved by fertilizer was developed on recently cleared land. Note the natural spread of clovers.**

**Below: At Mt. Pleasant, Texas, this land now a good pasture was retired from cultivation, sodded to Bermuda, then seeded to lespedeza.**

# The Editors Talk

## Getting Knowledge to Farmers

The proof is in the pudding, and the ultimate success of any agricultural extension or advisory service medium is the actual adoption of the practice by the farmer. Much research, experimentation, and years of effort have been expended toward this goal, and still any light or comment on the matter is appreciated.

British-American Agricultural News Service, No. 33, London, carries comments of an English farmer on the value of demonstration which we believe will be of interest to many of our readers. The item is quoted herewith:

"A farmer, originally destined to go into his father's manufacturing business, has been talking about the problem of getting knowledge from the laboratory to the ordinary, every-day, dirty-boot farmer, from the angle of the man on the land. He is Mr. Duncan McGuffie of Warwickshire.

"He stresses the importance of the human side. 'It's during a smoke after a meal,' he says 'that farmer and scientist begin to get down to real business and confide their troubles.' The scientist may not think it worth while to describe to the farmer the life history of the pest that is worrying him; the farmer may think it a waste of time to talk to the scientist about the previous manuring and cropping of his farm. But it is only by adding all the information together that the problem can eventually be solved.

"In common with many other farmers, says Mr. McGuffie, he thought it a waste of time to go around counting how many wireworm there were to the acre. He had seen crop failures when wireworm were few, and successes where wireworm were many. He thought the cultivations just had to be thorough to beat this pest. It was only after a count on the field, before and after various experimental cultivations, that it was found that reduction of the pest by half was attained by thorough working of the top five inches during the late summer months. This information has proved most useful to farmers breaking up old grassland for the first time.

"There are farms that would benefit by a visit from a scientist, but there are also research stations that would benefit by a visit from a farmer, and this reciprocal contact is essential, Mr. McGuffie thinks.

"Pamphlets, lectures, radio talks and films are all very well in their way. They act as useful can-openers for the farmer's mind and start him thinking. But if you really want to make a farmer grow potatoes, and he has never grown them before, the only way is to go and see him, tell him how to fit them into the rotation, pick out his most suitable land for the job, and then get him to go round the farm of the most successful potato grower in the neighborhood. There is nothing like field demonstrations under ordinary working conditions. That is what Mr. McGuffie thinks, and that also has been the wartime experience of the English Ministry of Agriculture.

" 'Finally,' says this Warwickshire farmer, 'it's time we stopped talking about one country being in front of another in farming knowledge. We have got to pool what we know. Each country has a contribution to make to the common good. If each country will bear in mind that the interests of world agriculture must come before the interests of their own national agriculture, then good progress is likely to be made and stability in prosperity secured.' "

## Fall Fairs

The agricultural fall fair, be it community, county, state, regional, or national is being heartily welcomed back. Cancellation of most of them for obvious reasons during the war has only served to make greater the realization that the fall fair is a stimulating experience to all participants as well as a very important asset to the betterment of our agriculture.

It has been said that there is no better criterion of a farming district than its fall fairs. They reflect the kind of people that live there and their efforts to improve their standard of living. They are an inspiration and source of pride for the entire community and a means of better understanding between rural and urban. Their educational value is well-known, but not so fully realized, perhaps, is their worth to the young people living on farms. The fairs themselves do not lack this appreciation, for the activities of the 4-H Clubs, Future Farmers of America, and other farm youth organizations have become prominently featured. Rightly so—there is no better time than the teen-age to instill enthusiasm for a profession and start the competition for the standards which will achieve success.

A fall fair is an agricultural convention. Let us hope that they will grow in number and scope.

## Good Farming

R. H. Bray, Professor of Soil Fertility, University of Illinois College of Agriculture, believes that good all-around farming is not just a matter of getting good yields, but includes the matter of maintaining or increasing the available nutrient supplies in the soil. It is good farming to produce high yields, he thinks, but it's bad farming to produce the high yields without replenishing the supply of plant nutrients in the soil through fertilization.

He likens the soil to a factory with the plant nutrients as the raw materials and adds that using up raw materials is what a factory is for, as one cannot get production without using raw materials. However, too many farmers view the soil not as a factory, but as an inexhaustible source of supply of these raw materials, the plant nutrients. The soil does have a large supply of available nutrients, but we have been using them at a fast rate; and if we wish to maintain high yields, we must maintain or build up a high available nutrient level.

"This means," Professor Bray says, "we must use fertilizers of one kind or another, depending on the soil's need for them. In the long run, it is more economical to maintain soil fertility than to deplete it and then try to build it back."

His suggestions to Illinois farmers include a visit to the county farm adviser to learn of the services available regarding soil testing. Soil tests will keep the farmer informed as to the fertility supplies, warn him when they get too low, and tell when they are sufficient. In this way no farmer need use fertilizers where they are not needed or farm certain soils without fertilizer where it is needed.

# Farm Prices of Farm Products*

| | Cotton Cents per lb. | Tobacco Cents per lb. | Potatoes Cents per bu. | Sweet Potatoes Cents per bu. | Corn Cents per bu. | Wheat Cents per bu. | Hay Dollars per ton | Cottonseed Dollars per ton | Truck Crops |
|---|---|---|---|---|---|---|---|---|---|
| 1910–14 Average | 12.4 | 10.4 | 69.6 | 87.6 | 64.8 | 88.0 | 11.94 | 21.59 | .... |
| 1920 | 32.1 | 17.3 | 249.5 | 175.7 | 144.2 | 224.1 | 21.26 | 51.73 | .... |
| 1921 | 12.3 | 19.5 | 103.8 | 118.7 | 58.7 | 119.0 | 12.96 | 22.18 | .... |
| 1922 | 18.9 | 22.8 | 96.7 | 104.8 | 58.5 | 103.2 | 11.68 | 35.04 | .... |
| 1923 | 26.7 | 19.0 | 84.1 | 104.4 | 80.1 | 98.9 | 12.29 | 43.69 | .... |
| 1924 | 27.6 | 19.0 | 87.0 | 137.0 | 91.2 | 110.5 | 13.28 | 38.34 | .... |
| 1925 | 22.1 | 16.8 | 113.9 | 171.6 | 99.9 | 151.0 | 12.54 | 35.07 | .... |
| 1926 | 15.1 | 17.9 | 185.7 | 156.3 | 69.9 | 135.1 | 13.06 | 27.20 | .... |
| 1927 | 15.9 | 20.7 | 132.3 | 114.0 | 78.8 | 120.5 | 12.00 | 28.56 | .... |
| 1928 | 18.6 | 20.0 | 82.9 | 112.3 | 89.1 | 113.4 | 10.63 | 37.70 | .... |
| 1929 | 17.7 | 18.6 | 93.7 | 118.4 | 87.6 | 102.7 | 11.56 | 34.98 | .... |
| 1930 | 12.4 | 12.9 | 124.4 | 115.8 | 78.0 | 80.9 | 11.31 | 26.25 | .... |
| 1931 | 7.6 | 8.2 | 72.7 | 92.9 | 49.8 | 48.8 | 9.76 | 17.04 | .... |
| 1932 | 5.8 | 10.5 | 43.3 | 57.2 | 28.1 | 38.8 | 7.53 | 9.74 | .... |
| 1933 | 8.1 | 12.9 | 66.0 | 59.4 | 36.5 | 58.1 | 6.81 | 12.32 | .... |
| 1934 | 12.0 | 17.1 | 68.0 | 79.1 | 61.3 | 79.8 | 10.67 | 26.12 | .... |
| 1935 | 11.6 | 16.1 | 49.4 | 73.9 | 77.4 | 86.4 | 10.57 | 35.56 | .... |
| 1936 | 11.7 | 17.2 | 99.6 | 85.3 | 76.7 | 96.0 | 8.93 | 31.78 | .... |
| 1937 | 11.1 | 19.9 | 88.3 | 91.8 | 94.8 | 107.1 | 10.36 | 30.24 | .... |
| 1938 | 8.3 | 17.2 | 55.5 | 76.9 | 49.0 | 66.1 | 7.55 | 21.13 | .... |
| 1939 | 8.7 | 15.4 | 68.1 | 75.4 | 47.6 | 63.6 | 6.95 | 22.17 | .... |
| 1940 | 9.6 | 16.0 | 70.7 | 85.2 | 59.0 | 73.9 | 7.62 | 24.31 | .... |
| 1941 | 13.3 | 26.4 | 64.6 | 94.4 | 64.3 | 84.0 | 8.10 | 35.04 | .... |
| 1942 | 18.51 | 36.9 | 110.0 | 108.3 | 79.5 | 101.8 | 10.05 | 44.42 | .... |
| 1943 | 19.84 | 40.5 | 149.2 | 196.7 | 102.7 | 127.3 | 12.82 | 48.26 | .... |
| 1944 | 20.39 | 41.8 | 141.0 | 213.5 | 113.3 | 142.8 | 15.43 | 52.80 | .... |
| September | 21.02 | 42.9 | 147.0 | 219.0 | 116.0 | 135.0 | 14.70 | 52.30 | .... |
| October | 21.25 | 41.2 | 142.0 | 185.0 | 113.0 | 142.0 | 15.20 | 52.70 | .... |
| November | 20.78 | 45.1 | 143.0 | 164.0 | 106.0 | 143.0 | 15.60 | 53.40 | .... |
| December | 20.85 | 43.5 | 150.0 | 175.0 | 106.0 | 145.0 | 16.50 | 53.10 | .... |
| 1945 | | | | | | | | | |
| January | 20.20 | 41.9 | 158.0 | 190.0 | 107.0 | 146.0 | 17.10 | 52.80 | .... |
| February | 19.99 | 31.8 | 165.0 | 201.0 | 106.0 | 147.0 | 17.70 | 52.70 | .... |
| March | 20.24 | 21.4 | 171.0 | 207.0 | 107.0 | 148.0 | 18.10 | 52.00 | .... |
| April | 20.20 | 21.4 | 174.0 | 211.0 | 107.0 | 149.0 | 16.90 | 51.90 | .... |
| May | 20.51 | 42.2 | 177.0 | 214.0 | 108.0 | 149.0 | 16.50 | 52.10 | .... |
| June | 20.90 | 51.2 | 180.0 | 220.0 | 111.0 | 150.0 | 15.90 | 52.50 | .... |
| July | 21.25 | 56.3 | 183.0 | 230.0 | 112.0 | 146.0 | 15.40 | 55.00 | .... |
| August | 21.33 | 44.9 | 167.0 | 256.0 | 113.0 | 145.0 | 14.60 | 52.50 | .... |
| September | 21.72 | 43.2 | 138.0 | 207.0 | 112.0 | 145.0 | 14.30 | 51.40 | .... |
| **Index Numbers (1910-14 = 100)** | | | | | | | | | |
| 1920 | 259 | 166 | 358 | 201 | 223 | 255 | 178 | 240 | .... |
| 1921 | 99 | 187 | 149 | 136 | 91 | 135 | 109 | 103 | .... |
| 1922 | 152 | 219 | 139 | 120 | 90 | 117 | 98 | 162 | .... |
| 1923 | 215 | 183 | 121 | 119 | 124 | 112 | 103 | 202 | .... |
| 1924 | 223 | 183 | 125 | 156 | 141 | 126 | 111 | 177 | 159 |
| 1925 | 178 | 161 | 164 | 196 | 154 | 172 | 105 | 162 | 153 |
| 1926 | 122 | 172 | 267 | 178 | 108 | 154 | 109 | 126 | 143 |
| 1927 | 128 | 199 | 190 | 130 | 122 | 137 | 101 | 132 | 121 |
| 1928 | 150 | 192 | 119 | 128 | 138 | 129 | 89 | 174 | 159 |
| 1929 | 143 | 179 | 135 | 135 | 135 | 117 | 97 | 162 | 149 |
| 1930 | 100 | 124 | 179 | 132 | 120 | 92 | 95 | 122 | 140 |
| 1931 | 61 | 79 | 104 | 106 | 77 | 55 | 82 | 79 | 117 |
| 1932 | 47 | 101 | 62 | 65 | 43 | 44 | 63 | 45 | 102 |
| 1933 | 65 | 124 | 95 | 68 | 56 | 66 | 57 | 57 | 105 |
| 1934 | 97 | 164 | 98 | 90 | 95 | 91 | 89 | 121 | 004 |
| 1935 | 94 | 155 | 71 | 84 | 119 | 98 | 89 | 165 | 126 |
| 1936 | 94 | 165 | 143 | 97 | 118 | 109 | 75 | 147 | 113 |
| 1937 | 90 | 191 | 127 | 105 | 146 | 122 | 87 | 140 | 122 |
| 1938 | 67 | 165 | 80 | 88 | 76 | 75 | 63 | 98 | 101 |
| 1939 | 70 | 148 | 98 | 86 | 73 | 72 | 58 | 103 | 109 |
| 1940 | 78 | 154 | 102 | 97 | 91 | 84 | 64 | 126 | 121 |
| 1941 | 107 | 254 | 93 | 108 | 99 | 95 | 68 | 162 | 145 |
| 1942 | 149 | 355 | 158 | 124 | 123 | 116 | 84 | 206 | 199 |
| 1943 | 160 | 389 | 214 | 225 | 158 | 145 | 107 | 224 | 245 |
| 1944 | 165 | 402 | 203 | 244 | 175 | 162 | 129 | 245 | 217 |
| September | 170 | 413 | 211 | 250 | 179 | 153 | 123 | 242 | 239 |
| October | 171 | 396 | 204 | 211 | 174 | 161 | 127 | 244 | 192 |
| November | 168 | 434 | 205 | 187 | 164 | 163 | 131 | 247 | 188 |
| December | 168 | 418 | 216 | 200 | 164 | 165 | 138 | 246 | 228 |
| 1945 | | | | | | | | | |
| January | 163 | 403 | 227 | 217 | 165 | 166 | 143 | 245 | 262 |
| February | 161 | 306 | 237 | 229 | 164 | 167 | 148 | 244 | 223 |
| March | 163 | 206 | 246 | 236 | 165 | 168 | 152 | 241 | 203 |
| April | 163 | 206 | 250 | 241 | 165 | 169 | 142 | 240 | 259 |
| May | 165 | 406 | 254 | 244 | 167 | 169 | 138 | 241 | 193 |
| June | 169 | 492 | 259 | 251 | 171 | 170 | 133 | 243 | 269 |
| July | 171 | 541 | 263 | 263 | 173 | 166 | 129 | 255 | 244 |
| August | 172 | 432 | 240 | 292 | 174 | 165 | 122 | 243 | 240 |
| September | 175 | 415 | 198 | 236 | 173 | 165 | 120 | 238 | 159 |

# Wholesale Prices of Ammoniates

| | Nitrate of soda per unit N bulk | Sulphate of ammonia bulk per unit N | Cottonseed meal S. E. Mills per unit N | Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N | Fish scrap, wet acidulated 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N | Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N | High grade ground blood, 16–17% ammonia Chicago, bulk, per unit N |
|---|---|---|---|---|---|---|---|
| 1910–14 | $2.68 | $2.85 | $3.50 | $3.53 | $3.05 | $3.37 | $3.52 |
| 1922 | 3.04 | 2.58 | 6.07 | 4.66 | 3.54 | 4.75 | 4.99 |
| 1923 | 3.02 | 2.90 | 6.19 | 4.83 | 4.25 | 4.59 | 5.16 |
| 1924 | 2.99 | 2.44 | 5.87 | 5.02 | 4.41 | 3.60 | 4.25 |
| 1925 | 3.11 | 2.47 | 5.41 | 5.34 | 4.70 | 3.97 | 4.75 |
| 1926 | 3.06 | 2.41 | 4.40 | 4.95 | 4.15 | 4.36 | 4.90 |
| 1927 | 3.01 | 2.26 | 5.07 | 5.87 | 4.35 | 4.32 | 5.70 |
| 1928 | 2.67 | 2.30 | 7.06 | 6.63 | 5.28 | 4.92 | 6.00 |
| 1929 | 2.57 | 2.04 | 5.64 | 5.00 | 4.69 | 4.61 | 5.72 |
| 1930 | 2.47 | 1.81 | 4.78 | 4.96 | 4.15 | 3.79 | 4.58 |
| 1931 | 2.34 | 1.46 | 3.10 | 3.95 | 3.33 | 2.11 | .46 |
| 1932 | 1.87 | 1.04 | 2.18 | 2.18 | 1.82 | 1.21 | 1.36 |
| 1933 | 1.52 | 1.12 | 2.95 | 2.86 | 2.58 | 2.06 | 2.46 |
| 1934 | 1.52 | 1.20 | 4.46 | 3.15 | 2.84 | 2.67 | 3.27 |
| 1935 | 1.47 | 1.15 | 4.59 | 3.10 | 2.65 | 3.06 | 3.65 |
| 1936 | 1.53 | 1.23 | 4.17 | 3.42 | 2.67 | 3.58 | 4.25 |
| 1937 | 1.63 | 1.32 | 4.91 | 4.66 | 3.65 | 4.04 | 4.80 |
| 1938 | 1.69 | 1.38 | 3.69 | 3.76 | 3.17 | 3.15 | 3.53 |
| 1939 | 1.69 | 1.35 | 4.02 | 4.41 | 3.12 | 3.87 | 3.90 |
| 1940 | 1.69 | 1.36 | 4.64 | 4.36 | 3.35 | 3.33 | 3.39 |
| 1941 | 1.69 | 1.41 | 5.50 | 5.32 | 3.27 | 3.76 | 4.43 |
| 1942 | 1.74 | 1.41 | 6.11 | 5.77 | 3.34 | 5.04 | 6.76 |
| 1943 | 1.75 | 1.42 | 6.30 | 5.77 | 3.34 | 4.86 | 6.62 |
| 1944 | 1.75 | 1.42 | 7.68 | 5.77 | 3.34 | 4.86 | 6.71 |
| September | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| October | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| November | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| December | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| 1945 | | | | | | | |
| January | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| February | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| March | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| April | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| May | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| June | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| July | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| August | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| September | 1.75 | 1.42 | 7.81 | 5.77 | 3.34 | 4.86 | 6.71 |
| **Index Numbers (1910-14 = 100)** | | | | | | | |
| 1922 | 113 | 90 | 173 | 132 | 117 | 140 | 142 |
| 1923 | 112 | 102 | 177 | 137 | 140 | 136 | 147 |
| 1924 | 111 | 86 | 168 | 142 | 145 | 107 | 121 |
| 1925 | 115 | 87 | 155 | 151 | 155 | 117 | 135 |
| 1926 | 113 | 84 | 126 | 140 | 146 | 129 | 139 |
| 1927 | 112 | 79 | 145 | 166 | 143 | 128 | 162 |
| 1928 | 100 | 81 | 202 | 188 | 173 | 146 | 170 |
| 1929 | 96 | 72 | 161 | 142 | 154 | 137 | 162 |
| 1930 | 92 | 64 | 137 | 141 | 136 | 12 | 130 |
| 1931 | 88 | 51 | 89 | 112 | 109 | 63 | 70 |
| 1932 | 71 | 36 | 62 | 62 | 60 | 36 | 39 |
| 1933 | 59 | 39 | 84 | 81 | 85 | 97 | 71 |
| 1934 | 59 | 42 | 127 | 89 | 93 | 79 | 93 |
| 1935 | 57 | 40 | 131 | 88 | 87 | 91 | 104 |
| 1936 | 59 | 43 | 119 | 97 | 89 | 106 | 131 |
| 1937 | 61 | 46 | 140 | 132 | 120 | 120 | 122 |
| 1938 | 63 | 48 | 105 | 106 | 104 | 93 | 100 |
| 1939 | 63 | 47 | 115 | 125 | 102 | 115 | 111 |
| 1940 | 63 | 48 | 133 | 124 | 110 | 99 | 96 |
| 1941 | 63 | 49 | 157 | 151 | 107 | 112 | 126 |
| 1942 | 65 | 49 | 175 | 163 | 110 | 150 | 192 |
| 1943 | 65 | 50 | 180 | 163 | 110 | 144 | 189 |
| 1944 | 65 | 50 | 219 | 163 | 110 | 144 | 191 |
| September | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| October | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| November | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| December | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| 1945 | | | | | | | |
| January | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| February | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| March | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| April | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| May | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| June | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| July | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| August | 65 | 50 | 223 | 163 | 110 | 144 | 191 |
| September | 65 | 50 | 223 | 163 | 110 | 144 | 191 |

# Wholesale Prices of Phosphates and Potash**

| | Superphosphate Baltimore, per unit | Florida land pebble 68% f.o.b. mines, bulk, per ton | Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton | Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports | Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports | Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports | Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1] | Kainit 20% bulk, per unit, c.i.f. Atlantic and Gulf ports |
|---|---|---|---|---|---|---|---|---|
| 1910–14 | $0.536 | $3.61 | $4.88 | $0.714 | $0.953 | $24.18 | $0.657 | $0.655 |
| 1922 | .566 | 3.12 | 6.90 | .632 | .904 | 23.87 | .... | .508 |
| 1923 | .550 | 3.08 | 7.50 | .588 | .836 | 23.32 | .... | .474 |
| 1924 | .502 | 2.31 | 6.60 | .582 | .860 | 23.72 | .... | .472 |
| 1925 | .600 | 2.44 | 6.16 | .584 | .860 | 23.72 | .... | .483 |
| 1926 | .598 | 3.20 | 5.57 | .596 | .854 | 23.58 | .537 | .524 |
| 1927 | .525 | 3.09 | 5.50 | .646 | .924 | 25.55 | .586 | .581 |
| 1928 | .580 | 3.12 | 5.50 | .669 | .957 | 26.46 | .607 | .602 |
| 1929 | .609 | 3.18 | 5.50 | .672 | .962 | 26.59 | .610 | .605 |
| 1930 | .542 | 3.18 | 5.50 | .681 | .973 | 26.92 | .618 | .612 |
| 1931 | .485 | 3.18 | 5.50 | .681 | .973 | 26.92 | .618 | .612 |
| 1932 | .458 | 3.18 | 5.50 | .681 | .963 | 26.90 | .618 | .591 |
| 1933 | .434 | 3.11 | 5.50 | .662 | .864 | 25.10 | .601 | .565 |
| 1934 | .487 | 3.14 | 5.67 | .486 | .751 | 22.49 | .483 | .471 |
| 1935 | .492 | 3.30 | 5.69 | .415 | .684 | 21.44 | .444 | .488 |
| 1936 | .476 | 1.85 | 5.50 | .464 | .708 | 22.94 | .505 | .560 |
| 1937 | .510 | 1.85 | 5.50 | .508 | .757 | 24.70 | .556 | .607 |
| 1938 | .492 | 1.85 | 5.50 | .523 | .774 | 15.17 | .572 | .623 |
| 1939 | .478 | .190 | 5.50 | .521 | .751 | 24.52 | .570 | .670 |
| 1940 | .516 | .190 | 5.50 | .517 | .730 | 24.75 | .573 | .... |
| 1941 | .547 | 1.94 | 5.64 | .522 | .780 | 25.55 | .570 | .... |
| 1942 | .600 | 2.13 | 6.29 | .522 | .810 | 25.74 | .205 | .... |
| 1943 | .631 | 2.00 | 5.93 | .522 | .786 | 25.35 | .195 | .... |
| 1944 | .645 | 2.10 | 6.10 | .522 | .777 | 25.35 | .195 | .... |
| September | .650 | 2.20 | 6.10 | .503 | .749 | 24.44 | .188 | .... |
| October | .650 | 2.20 | 6.10 | .535 | .797 | 26.00 | .200 | .... |
| November | .650 | 2.20 | 6.10 | .535 | .797 | 26.00 | .200 | .... |
| December | .650 | 2.20 | 6.10 | .535 | .797 | 26.00 | .200 | .... |
| 1945 | | | | | | | | |
| January | .650 | 2.20 | 6.10 | .535 | .797 | 26.00 | .200 | .... |
| February | .650 | 2.20 | 6.13 | .535 | .797 | 26.00 | .200 | .... |
| March | .650 | 2.20 | 6.20 | .535 | .797 | 26.00 | .200 | .... |
| April | .650 | 2.20 | 6.20 | .535 | .797 | 26.00 | .200 | .... |
| May | .650 | 2.20 | 6.20 | .535 | .797 | 26.00 | .200 | .... |
| June | .650 | 2.20 | 6.20 | .471 | .701 | 22.88 | .176 | .... |
| July | .650 | 2.20 | 6.20 | .503 | .749 | 24.44 | .188 | .... |
| August | .650 | 2.20 | 6.20 | .503 | .749 | 24.44 | .188 | .... |
| September | .650 | 2.20 | 6.20 | .503 | .749 | 24.44 | .188 | .... |

## Index Numbers (1910-14 = 100)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1922 | 106 | 87 | 141 | 89 | 95 | 99 | .... | 78 |
| 1923 | 103 | 85 | 154 | 82 | 88 | 96 | .... | 72 |
| 1924 | 94 | 64 | 135 | 82 | 90 | 98 | .... | 72 |
| 1925 | 110 | 68 | 126 | 82 | 90 | 98 | .... | 74 |
| 1926 | 112 | 88 | 114 | 83 | 90 | 98 | 82 | 80 |
| 1927 | 100 | 86 | 113 | 90 | 97 | 106 | 89 | 89 |
| 1928 | 108 | 86 | 113 | 94 | 100 | 109 | 92 | 92 |
| 1929 | 114 | 88 | 113 | 94 | 101 | 110 | 93 | 92 |
| 1930 | 101 | 88 | 113 | 95 | 102 | 111 | 94 | 93 |
| 1931 | 90 | 88 | 113 | 95 | 102 | 111 | 94 | 93 |
| 1932 | 85 | 88 | 113 | 95 | 101 | 111 | 94 | 90 |
| 1933 | 81 | 86 | 113 | 93 | 91 | 104 | 91 | 86 |
| 1934 | 91 | 87 | 110 | 68 | 79 | 93 | 74 | 72 |
| 1935 | 92 | 91 | 117 | 58 | 72 | 89 | 68 | 75 |
| 1936 | 89 | 51 | 113 | 65 | 74 | 95 | 77 | 85 |
| 1937 | 95 | 51 | 113 | 71 | 79 | 102 | 85 | 93 |
| 1938 | 92 | 51 | 113 | 73 | 81 | 104 | 87 | 95 |
| 1939 | 89 | 53 | 113 | 73 | 79 | 101 | 87 | 93 |
| 1940 | 96 | 53 | 113 | 72 | 77 | 102 | 87 | .... |
| 1941 | 102 | 54 | 110 | 73 | 82 | 106 | 87 | .... |
| 1942 | 112 | 59 | 129 | 73 | 85 | 106 | 84 | .... |
| 1943 | 117 | 55 | 121 | 73 | 82 | 105 | 83 | .... |
| 1944 | 120 | 58 | 125 | 73 | 82 | 105 | 83 | .... |
| September | 121 | 61 | 125 | 70 | 79 | 101 | 82 | .... |
| October | 121 | 61 | 125 | 75 | 84 | 108 | 83 | .... |
| November | 121 | 61 | 125 | 75 | 84 | 108 | 83 | .... |
| December | 121 | 61 | 125 | 75 | 84 | 108 | 83 | .... |
| 1945 | | | | | | | | |
| January | 121 | 61 | 125 | 75 | 84 | 108 | 83 | .... |
| February | 121 | 61 | 126 | 75 | 84 | 108 | 83 | .... |
| March | 121 | 61 | 127 | 75 | 84 | 108 | 83 | .... |
| April | 121 | 61 | 127 | 75 | 84 | 108 | 83 | .... |
| May | 121 | 61 | 127 | 75 | 84 | 108 | 83 | .... |
| June | 121 | 61 | 127 | 66 | 74 | 95 | 80 | .... |
| July | 121 | 61 | 127 | 70 | 79 | 101 | 82 | .... |
| August | 121 | 61 | 127 | 70 | 79 | 101 | 82 | .... |
| September | 121 | 61 | 127 | 70 | 79 | 101 | 82 | .... |

# Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

| | Farm prices* | Prices paid by farmers for commodities bought* | Wholesale prices of all commodities† | Fertilizer materials‡ | Chemical ammoniates | Organic ammoniates | Superphosphate | Potash |
|---|---|---|---|---|---|---|---|---|
| 1922..... | 132 | 149 | 141 | 116 | 101 | 145 | 106 | 85 |
| 1923..... | 143 | 152 | 147 | 114 | 107 | 144 | 103 | 79 |
| 1924..... | 143 | 152 | 143 | 103 | 97 | 125 | 94 | 79 |
| 1925..... | 156 | 156 | 151 | 112 | 100 | 131 | 109 | 80 |
| 1926..... | 146 | 155 | 146 | 119 | 94 | 135 | 112 | 86 |
| 1927..... | 142 | 153 | 139 | 116 | 89 | 150 | 100 | 94 |
| 1928..... | 151 | 155 | 141 | 121 | 87 | 177 | 108 | 97 |
| 1929..... | 149 | 154 | 139 | 114 | 79 | 146 | 114 | 97 |
| 1930..... | 128 | 146 | 126 | 105 | 72 | 131 | 101 | 99 |
| 1931..... | 90 | 126 | 107 | 83 | 62 | 83 | 90 | 99 |
| 1932..... | 68 | 108 | 95 | 71 | 46 | 48 | 85 | 99 |
| 1933..... | 72 | 108 | 96 | 70 | 45 | 71 | 81 | 95 |
| 1934..... | 90 | 122 | 109 | 72 | 47 | 90 | 91 | 72 |
| 1935..... | 109 | 125 | 117 | 70 | 45 | 97 | 92 | 63 |
| 1936..... | 114 | 124 | 118 | 73 | 47 | 107 | 89 | 69 |
| 1937..... | 122 | 131 | 126 | 81 | 50 | 129 | 95 | 75 |
| 1938..... | 97 | 123 | 115 | 78 | 52 | 101 | 92 | 77 |
| 1939..... | 95 | 121 | 112 | 79 | 51 | 119 | 89 | 77 |
| 1940..... | 100 | 122 | 115 | 80 | 52 | 114 | 96 | 77 |
| 1941..... | 124 | 131 | 127 | 86 | 56 | 130 | 102 | 77 |
| 1942..... | 159 | 152 | 144 | 93 | 57 | 161 | 112 | 77 |
| 1943..... | 192 | 167 | 150 | 94 | 57 | 160 | 117 | 77 |
| 1944..... | 195 | 176 | 151 | 96 | 57 | 174 | 120 | 76 |
| September. | 192 | 176 | 151 | 96 | 57 | 175 | 121 | 74 |
| October... | 194 | 176 | 152 | 97 | 57 | 175 | 121 | 78 |
| November. | 196 | 177 | 152 | 97 | 57 | 175 | 121 | 78 |
| December.. | 200 | 178 | 152 | 97 | 57 | 175 | 121 | 78 |
| 1945 | | | | | | | | |
| January... | 201 | 179 | 153 | 97 | 57 | 175 | 121 | 78 |
| February.. | 199 | 179 | 153 | 97 | 57 | 175 | 121 | 78 |
| March.... | 198 | 180 | 153 | 97 | 57 | 175 | 121 | 78 |
| April..... | 203 | 180 | 154 | 97 | 57 | 175 | 121 | 78 |
| May..... | 200 | 180 | 154 | 97 | 57 | 175 | 121 | 78 |
| June..... | 206 | 180 | 155 | 95 | 57 | 175 | 121 | 69 |
| July..... | 206 | 180 | 154 | 96 | 57 | 175 | 121 | 74 |
| August.... | 204 | 180 | 154 | 96 | 57 | 175 | 121 | 74 |
| September. | 197 | 181 | 153 | 96 | 57 | 175 | 121 | 74 |

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.

# REVIEWS

**This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.**

## Fertilizer

*"Bureau of Chemistry, Annual Report for the Calendar Year 1944," Dept. of Agri., Sacramento, Calif.*

*"Plant Nutrient Survey of Sugar Beets for 1944," Div. of Plant Nutrition, Univ. of Calif., Berkeley, Calif., July 1945, Albert Ulrich.*

*"Phosphate Fertilization Pays," Univ. of Idaho, Moscow, Idaho, War Cir. 44, April 1945, J. L. Toevs, G. Orien Baker, R. S. Snyder, and Olof E. Stamberg.*

*"County Fertilizer Data: Mixed Goods and Materials, July 1, 1944-June 30, 1945," State Dept. of Agr., Jackson, Miss.*

*"Commercial Fertilizers, Suggestions for Use in Nebraska—1944," Ext. Serv., Agr. College, Lincoln, Nebr., E. C. 150, Jan. 1944, J. W. Fitts and H. F. Rhoades.*

*"Using Nitrogen Fertilizers in Nebraska," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Cir. 163, Feb. 1945, J. W. Fitts, H. F. Rhoades, and J. R. McHenry.*

*"Nitrate of Soda as a Fertilizer for Corn," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 196, June 1945, C. A. Mooers.*

## Soils

*"Irrigation of Arable Crops on a Rice Soil," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 455, June 1945, R. P. Bartholomew, L. C. Kapp, and Martin Nelson.*

*"Crop and Pasture Lands in the Postwar Period," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 98, Feb. 1945.*

*"Watershed Protection, Recreation, Wildlife, Range Use on the Forest Lands," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 101, May 1945.*

*"The Land Nobody Wanted," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 332, April 1945, Harold Titus, L. R. Schoenmann, P. M. Barrett, H. A. Berg, and F. P. Struhsaker.*

*"Rhode Island Soil Types: Texture and Chemical Composition, and a Utility Index," Agr. Exp. Sta., Kingston, R. I., Bul. 296, March 1945, J. B. Smith and B. E. Gilbert.*

*"Physical Land Conditions in Greene County, Georgia," U.S.D.A., Washington, D. C., Phys. Land Survey No. 23, 1941, D. P. Powell and C. B. Gay.*

*"Physical Land Conditions on the Leatherwood Creek Demonstration Project, Lawrence County, Indiana," U.S.D.A., Washington, D. C., Phys. Land Survey No. 24, 1941, D. R. Kunkel, C. A. Engberg, and C. L. Whiteford.*

*"Physical Land Conditions in Tama County, Iowa," U.S.D.A., Washington, D. C., Phys. Land Survey No. 27, 1943, J. A. Bonsteel, J. A. Elwell, and R. R. Finley.*

*"Physical Land Conditions on the Farmersburg-McGregor Project, Clayton County, Iowa," U.S.D.A., Washington, D. C., Phys. Land Survey No. 28, 1942, D. E. Perfect and D. A. Sheetz.*

*"Physical Land Conditions in Washington County, Minnesota," U.S.D.A., Washington, D. C., Phys. Land Survey No. 36, 1944, J. A. Bonsteel and G. A. Simpson.*

*"Physical Land Conditions in Chariton County, Missouri," U.S.D.A., Washington, D. C., Physical Land Survey No. 25, 1942, D. C. Maxwell.*

## Crops

¶ A convenient reference book of agricultural information has been prepared by the North Carolina Extension Service and is entitled, "Handbook for Agricultural Workers." This little vest-pocket book has a surprisingly large amount of information necessarily much condensed. One section is devoted to crops and gives brief information on varieties, seeding rate and time, fertilization, lime requirement, and other related data. Nutrients removed by crops, analysis of fertilizer materials, control of weeds, nutrient-deficiency symptoms in plants, the functions of nutrients in plants, and a table of principal soils in North Carolina also are considered in this section. Other sections deal with livestock, plant pests, diseases of poultry, forestry, and agricultural engineering.

¶ The interest in gardens induced by war necessity still continues. In order

to supply the information required by many and aid them in producing better gardens, many experiment stations and extension services are issuing excellent bulletins on gardens. These have been listed from time to time on these pages and are too numerous to review in detail. Two examples of these publications are mentioned here because they are particularly attractive and complete. Cornell Extension Bulletin 631, Victory Gardening, by A. J. Pratt, W. E. Blauvelt, and A. W. Dimock, in addition to the usual general and specific information on cultural practices, include numerous color illustrations showing diseases, plant pests, and cultural practices. Michigan Agricultural Extension Bulletin 4, The Home Vegetable Garden, by P. R. Krone, R. Hutson, H. C. Moore, J. H. Muncie, and J. Tyson gives considerable information on individual vegetable plants and the control of diseases and pests, in addition to general suggestions on gardening.

¶ Since nearly every rose grower has his own way of growing the plants, it may be said that the growing of roses is more of an art than a science. Commercial growers, however, usually feel they cannot afford to indulge in what appears to be some of the fanciful practices of the legion of amateur growers. A. Laurie and D. C. Kiplinger have made a very thorough study of rose growing and have reduced it to as near a science as probably the growing of any plant can be. The results are given in Ohio Agricultural Experiment Station Bulletin 654 entitled, "Culture of Greenhouse Roses." Very detailed information is given on soils and their management, type of plant, planting, fertilization, temperature and other greenhouse conditions, culture of the plants, diseases, and harvesting. A section on the growing of roses in gravel culture also is included. The discussion on fertilization of roses in its various aspects is very complete with considerable attention given to the effects of nutrient deficiencies and excesses on the plant. Amateur as well as professional rose growers will find this worthwhile.

*"The Chemical Composition of Native Forage Plants of Southern Alberta and Saskatchewan in Relation to Grazing Practices," Dom. of Canada, Dept. of Agr., Ottawa, Canada, Publ. 769, T. Bul. 54, June 1945, S. E. Clarke and E. W. Tisdale.*

*"Growing and Handling Water-Core Diseases (Rots) Insects," Ont. Agr. College, Guelph, Ont., 1945.*

*"Raspberry Production in Colorado," Ext. Serv., Colo. A. & M. College, Fort Collins, Colo., Bul. 385-A, Jan. 1945, L. R. Bryant, W. A. Kreutzer, J. L. Hoerner, and C. M. Drage.*

*"Report of the Director for the Year Ending October 31, 1944," Agr. Exp. Sta., New Haven, Conn., Bul. 484, March 1945.*

*"Agricultural Experiment Station Annual Report for the Fiscal Year Ending June 30, 1944," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.*

*"The Effects of Moisture on Peanuts and Peanut Products," Ga. Exp. Sta., Experiment, Ga., Bul. 241, May 1945, J. G. Woodroff, S. R. Cecil, and H. H. Thompson.*

*"Kaimi Spanish Clover for Humid Lowland Pastures of Hawaii," Hawaii Agr. Exp. Sta., Honolulu, U.S.A., Cir. 22, Feb. 1945, E. Y. Hosaka.*

*"Thirteenth Biennial Report of the Dept. of Agriculture, State of Idaho," Boise, Idaho, 1943-1944.*

*"The Effects of Storage on the Chemical Composition of Some Inbred and Hybrid Strains of Sweet Corn," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 503, 1945, D. M. Doty, G. M. Smith, J. R. Roach, and J. T. Sullivan.*

*"Kansas Corn Tests, 1944," Agr. Exp. Sta., Kansas State College of Agr., Manhattan, Kansas, Bul. 325, Feb. 1945, A. L. Clapp, E. G. Heyne, C. D. Davis, and W. O. Scott.*

*"Buffalo Alfalfa," Agr. Exp. Sta., Kansas State College, Manhattan, Kansas, Cir. 226, April 1945, C. O. Grandfield.*

*"Year of Victory on Louisiana's Farm Front," Agr. Ext. Serv., Baton Rouge, La.*

*"The Maine Agricultural Experiment Station, 60th Annual Report," Univ. of Me., Orono, Me., 1943-1944.*

*"Growing Snap Beans for Canning," Agr. Ext. Serv., Univ. of Me., Orono, Me., Cir. 218, May 1945.*

*"Fifty-First Annual Report Agricultural Experiment Station University of Minnesota," Univ. Farm, St. Paul, Minn.*

*"History of the Missouri College of Agriculture," Univ. of Mo., Columbia, Mo., Bul. 483, Oct. 1944, F. B. Mumford.*

*"Commercial Grape Growing in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 484, Nov. 1944, T. J. Talbert.*

*"Experiments with Safflower in Western Nebraska," Agr. Exp. Sta., Univ. of Nebr. College of Agr., Lincoln, Nebr., Bul. 376, March 1945, C. E. Claassen and T. A. Kiesselbach.*

*"Farm Science in War and Peace," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Annual Report 1943-1944.*

*"Care of Evergreens," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 497, June 1945, C. H. Connors.*

*"Dry-Bean Production in New York," Cornell Univ., Ithaca, N. Y., Bul. 669, Feb. 1945, E. V. Hardenburg.*

*"Native Forage Plants," Agr. Exp. Sta., Raleigh, N. C., Bul. 353, Aug. 1945, H. H. Biswell, R. W. Collins, J. E. Foster, and T. S. Boggess, Jr*

*"Corn Fertilization Studies in 1944," Agr. Exp. Sta., Raleigh, N. C., Agron. Inf. Cir. 139, Jan. 1945, B. A. Krantz.*

*"Small Grain Results," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-141, May 1945, C. B. Cross.*

*"Grazing Trials: Winter Small Grains and Ryegrass Palatability Comparisons of Six Crops, Fertilized and Unfertilized," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-142, May 1945, Hi W. Staten.*

*"Forage Production of Winter Small Grain Varieties and Annual Rye Grass and Effect of Clipping Upon Grain Yields," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-143, May 1945, Hi W. Staten and Ernest H. Muncrief.*

*"Science for the Farmer," Agr. Exp. Sta., State College, Penna., Bul. 464, 57th A. R., June 1945, D. C. Sprague, W. F. Ackerman, and J. S. Cobb.*

*"Fifty-Seventh Annual Report Rhode Island State College Agricultural Experiment Station," Agr. Exp. Sta., Kingston, R. I., Cont. 674, April 1945.*

*"Forward in '44—United in Service," Agr. Ext. Serv., Kingston, R. I., Bul. 92, March 1945.*

*"Turf Management in Rhode Island," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Mis. Publ. 26, May 1945, Robert S. Bell, Cedric Jennings, and H. L. Keil.*

*"Fifty-Seventh Annual Report of the South Carolina Experiment Station of Clemson Agricultural College," Clemson, S. C., Feb. 1945.*

*"Better Home Grounds Growing and Transplanting Trees and Shrubs," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 196, June 1945 (Rev.), W. C. Pelton.*

*"Farm Ponds," Agr. Exp. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 238, (Rev.), May 1944, G. E. Martin.*

*"How You Can Detassel Corn," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Leaf. 79, June 1945.*

*"Sixteenth Biennial Report," Dept. of Agr., Olympia, Wash., Oct. 1, 1942 to Sept. 30, 1944.*

*"Better Management on Southern Coastal Forest Ranges," U.S.D.A., Washington, D. C. AIS-17, 1945.*

*"Regional Studies of Time of Planting and Hill Spacing of Sweet Potatoes," U.S.D.A., Washington, D. C., Cir. 725, May 1945, W. S. Anderson, H. L. Cochran, J. B. Edmond, O. B. Garrison, R. E. Wright, and V. R. Boswell.*

## Economics

¶ With the return of men from the armed services and reduction in numbers of workers employed in industries expanded due to war work, agriculture again is going to be called upon to act as a buffer in absorbing many of these people. In most cases, those returning to the land under these conditions will have the advantage of a good supply of money of their own or easily available credit. Many of our agricultural leaders, however, are frankly worried over the situation, and they have good reason to be, judging from the results of similar conditions at the close of World War I. Men who had never farmed before made unwise investments in an enterprise they were temperamentally not suited to conduct, while others overexpanded and thus were victims of a depression which followed.

In order to prevent, or at least reduce such a possibility after this war, the U. S. Department of Agriculture and several state experiment stations are issuing pamphlets and booklets on the subject. Some of these deal only with points to consider in the selection of a farm. This type of bulletin is well suited to those who already have had farm experience. Other publications discuss the general field of farming, its good points and its difficulties. This type of publication should be read especially by those who are not farm trained. Such a person can easily be misled by the pleasant side of agricultural life and not be prepared for the hard sides which are inevitable.

U. S. Department of Agriculture publication AWI-105 entitled "Shall I Be a Farmer?" by P. V. Maris should be read by everybody who is thinking of going into farming. It presents both the pleasant and the hard side of farming and gives some good general information on points to consider in deciding whether to farm and where to farm. Another publication of a similar nature is Kentucky Extension Circular 401

entitled "Farming as a Business" by L. A. Bradford. This considers primarily the economic side of farming. Farm Credit Administration Circular No. E-29, "About That Farm You're Going to Buy," also gives some good information on going into the farming business and what may happen.

Cornell University has issued two publications: Extension Bulletin 652, "Suggestions to Persons Who Plan to Farm or to Live in the Country," by V. B. Hart gives a general discussion on farming from the sociological and economic viewpoints; Bulletin 412 by H. S. Tyler gives specific information and suggestions in connection with the actual purchase of a farm as indicated by the title, "Buying a Farm in New York." A similar type of bulletin is Maine Extension Bulletin 326, "Choosing and Buying a Maine Farm," by C. H. Merchant.

Other general types of publications dealing with this subject are Wisconsin Extension Circular 347, "Some Questions to Ask When Buying a Farm," by W. W. Wilcox and P. E. McNall; California Experiment Station Circular 358, "California Farms: To Buy or Not to Buy," by R. L. Adams; and Missouri Agricultural Experiment Station Circular 293, "Establishing Discharged Service Men and War Workers on Farms," by O. R. Johnson. Many other stations have issued similar bulletins and circulars, and every person who is thinking of buying a farm or even adding to his present holdings if already on the land should read the publications issued by his own state and as many other states as possible. In this way wise investments can be made and misfortunes may be avoided.

*"1944 Orange County Avocado Production Cost Analysis," Agr. Ext. Serv., Univ. of Calif., Santa Ana, Calif., 15th Annual Summary.*

*"An Economic Study of Land Settlement in Representative Pioneer Areas of Northern Saskatchewan," Dominion of Canada, Dept. of Agr., Ottawa, Canada, Publ., 767, T. Bul. 52, June 1945, R. A. Stutt and H. Van Vliet.*

*"Directory of Co-operative Associations in Canada 1945," Dominion of Canada, Dept. of Agr., Ottawa, Canada, Publ. 772, F.B. 129, May 1945.*

## A Little Boron Boosts Sweet Potato Yields

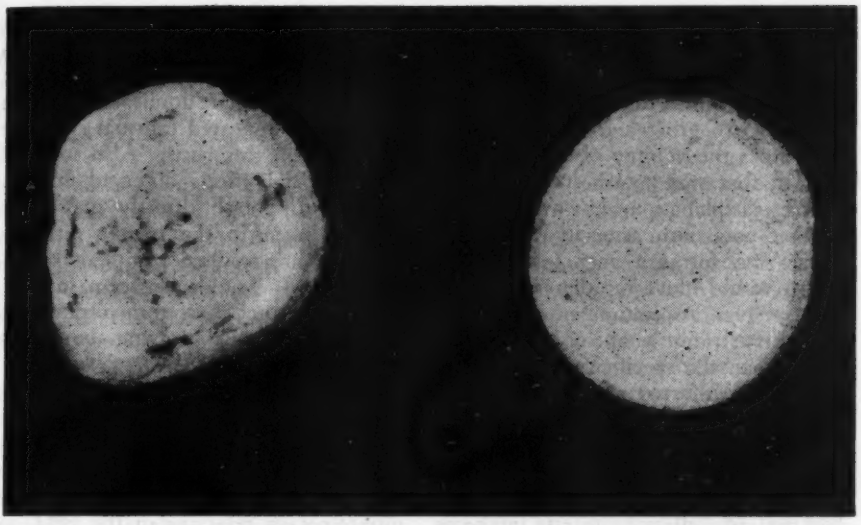
(*From page* 12)

not definitely detected until the latter part of August, when they appeared on some of the no-borax plots. By mid-October, however, the deficiency symptoms were quite pronounced on all of the no-borax plots and continued to be absent on plots supplied with borax. At first, terminal elongation of the vines was restricted and the internodes became shortened; then the petioles became curled and twisted. In advanced cases, the growing tips of the vines were stunted and distorted. Death of terminal buds and cessation of vine growth were observed late in the season. In October, the boron-deficient plants generally showed a rapid decline in growth. The older leaves became yellow in color and shed from the vines.

Dr. Nusbaum reports that in a few individual sweet potatoes taken from plants with above-ground symptoms of boron deficiency there were signs of internal breakdown. These necrotic areas in the potatoes were brown in color and irregular in size and shape, and he thinks the condition is associated with boron deficiency but has no confirmation on this point.

### Caution Needed

While little is yet known about the boron content of sweet potato soils, undoubtedly many soils contain a supply not adequate to meet the plant nutri-



**Left, cross-section of sweet potato from a plant showing severe boron-deficiency symptoms. Right, cross-section of sweet potato from a plant given borax and showing no boron-deficiency symptoms.**

tion needs of the sweet potato, Dr. Nusbaum concludes. But he advises extreme caution to avoid injury from too much boron.

"A recommendation of five pounds of borax per acre seems justifiable," he advises. "Theoretically, this amount is great enough to correct most cases of deficiency, and is not great enough to introduce risk of injury. In order to insure even distribution of the borax it should be thoroughly mixed with the complete fertilizer. If 1,000 pounds of fertilizer are used per acre, a mixture containing 10 pounds of borax per ton would suffice."

## A Potash-Nitrate Relationship

(*From page* 14)

ditions of this experiment there was some relationship between the presence of potash and nitrate in the corn plant. The data presented indicate that where potash was deficient, nitrates were low in the plant, even though a nitrogen fertilizer had been applied. When potash was sufficient or abundant, a good supply of nitrate was found, even though no nitrogen had been applied as a fertilizer. It is likely, of course, that on a soil deficient in nitrogen, the plants would show low in nitrate even if potash were abundant.

There have been observations made on potassium-nitrogen relations in the plant and the indications have been that potassium is essential in the reduction of nitrate preliminary to protein formation. The simplest and most obvious interpretation of the data presented in this paper is that potassium may be important in the intake of nitrate nitrogen by the corn plant. The question of the exact role played by potassium cannot be answered with the data at hand. The potassium deficiency may have been so severe that it resulted in some malfunction of the roots, inhibiting to some extent the nitrate-imbibing ability

of the plant. The application of potash did have a tremendous effect on the volume of roots produced. Potash applied on one hill, for example, enabled the plants to grow a root system over four times the volume of a nearby hill of corn that was potash starved. The simplest explanation, however, might be that potassium associated with the nitrate ion forms a very soluble salt, which would move rapidly in soil and plant. The association of potassium and nitrate might be one of convenience rather than the specificity which could easily be inferred from the data. Whether or not an abundant supply of other cations like $Ca^{++}$, $Mg^{++}$, and $Na^{+}$, which form readily soluble salts with the nitrate ion, might have had the same effect on nitrate intake as potassium can be answered only with some investigation along this line.

Assuming the interpretation of the data to be substantially correct, in that nitrate absorption is inhibited by a lack of potassium, the non-response of crops to nitrogen application which might have appeared unusual could be explained on this basis. Also some of the beneficial effects observed and attributed to potash directly may have been indirect, in that better nitrogen nutrition has resulted from potash application. It would also seem inadvisable to interpret data from nitrate tests on tissues without knowing the potash status as well.

The simplest answers to the interesting relationship shown in the table may not be the correct ones, but the observations presented might lead to further investigation and study of the nitrate-potash relations in the field, in the course of which further knowledge concerning the nutrition of the plant will be obtained.

---

## More Vegetables for Less Money

(*From page* 10)

hilled over the fertilizer and the plants set on top, or a horse cultivator was run through the fertilizer to mix it with the soil. There were a number of modifications. Fertilizer was placed on top of the seed in some cases. Those with an old potato planter, used it to apply all their fertilizer for wide row crops. The hill method of throwing a handful of fertilizer into a hole before the seed was dropped in or the plant was set was another modification. These methods had some virtue as long as small quantities of fertilizer were used, but when growers started using between 1,000 and 3,000 pounds of fertilizer they were in trouble. In wet years, their crops all went to foliage and in dry years the fertilizer burned the roots so that crop failures resulted. If weather conditions were "exactly right," yields were very good.

The band method was an improvement and eliminated many of the hazards. It increased average yields because it eliminated fertilizer injury. For quantities of 1,000 pounds or less of fertilizer, it had many advantages. Also, on acid soils it supposedly was the best method since it prevented phosphate fixation. However, it tended to restrict lateral root growth and contributed to shallow root penetration. In crop rotations, it had many disadvantages because fertilizer was only applied to the row crop. The unfertilized crop made a very uneven growth.

Placing the bands deeper at planting time or on the furrow bottom is an improvement since it encourages better root distribution and places the fertilizer where more uniform moisture conditions exist. It tends to lower the concentration in the immediate vicinity of the roots. Furthermore, for surface soils that must be maintained in an

acid condition, it offers the possibility of applying small quantities of limestone without interfering with the pH of the surface soil.

For all general purposes over a period of years on soils that have been limed and where more than 750 pounds of fertilizer are to be applied, the methods that distribute the fertilizer more generally through the soil have produced larger yields and probably account for the growing popularity of plowing fertilizer under.

Broadcasting the fertilizer after plowing is a common practice. If the fertilizer is thoroughly mixed with the soil by means of a spring tooth harrow, it is fairly effective for narrow-rowed crops. A disc harrow does not satisfactorily mix the fertilizer and soil. Applying the fertilizer with a disc drill is a decided improvement over the broadcasting method. This places the fertilizer four to six inches deep in bands seven inches apart and has given as good results for tomatoes as any other method. If the ground is roughly plowed and the fertilizer is broadcast before the soil is leveled, the fertilizer will be distributed more satisfactorily than where it is applied after the ground has been leveled. This method is far more effective in wet years than in dry years.

Broadcasting the fertilizer before plowing has given uniformly better results over a period of years in our experimental plot studies than any other method, and its efficiency improves with the years. Theoretically it has many advantages and none of the disadvantages of the other methods. It not only supplies crops with a uniform diet throughout the growing season, but it places much of the plant nutrient materials deep enough so that more favorable moisture conditions prevail. This means much in terms of phosphate availability. The gypsum in superphosphate, by being placed close to the subsoil, promotes better root distribution because of its effect on the clay. This phase of fertilizer placement has not been given sufficient attention. The effect on the soil in improving aeration probably accounts for the fact that the efficiency of the fertilizer seems to increase from year to year when applied by this method. The application of fertilizer by this method probably requires the least equipment and the least amount of labor, and every grower who uses upwards of 800 pounds of fertilizer should try the method on his farm in comparison with other methods that he may use. On some acid soils it may not be as effective in promoting yields as some other method.

Side-dressing crops with fertilizers has been a common practice, but it is probably the most faulty method in use, and probably the least effective. There are too many things that can go wrong. The weather can be too dry. If the fertilizer is placed deep where it will do the most good, the roots often are cut off and the crop is checked. Side-dressing tends to concentrate the fertilizer close to the plants. Most crops should receive the plant food early in the season, but too many growers get it on too late. Side-dressing also tends to make the growth sporadic. The method is commonly used on sandy soils, but our results show that even on the lightest sands fertilizer plowed under is far more effective. If fertilizer is to be side-dressed, it should be applied in solution form.

### Problem Fields

There are many problem fields on all types of soil which respond to subsoil applications of superphosphate. These problem fields are the result of neglect. There has not been enough lime used to maintain a suitable pH in the subsoil. Surface applications of fertilizer have interfered with the beneficial effects that might have resulted from the action of gypsum on the subsoil. As a result, our crops on such soils are shallow rooted, make sporadic growth, and yield poorly. The remedy for such conditions is sufficient magnesium liming material applied on the surface before and after plowing, deeper plowing, and broadcasting the fertilizer be-

fore plowing. In some cases it may take two or three years before maximum yields are obtained. The use of subsoil plows with attachments to apply moderate quantities of limestone and superphosphate in the subsoil will speed up the corrective action.

The use of transplanting solutions, starter solutions for seed-sown crops, and booster solutions for side-dressings offer tremendous possibilities for the future. Theoretically, they offer the ideal method of distributing fertilizer. Whether it is to distribute 10 pounds or 1,000 pounds, the fertilizer solution offers the most uniform method of applying fertilizer, and in many cases the most efficient method. Insoluble forms of phosphates, inadequate supplies of water, and lack of equipment for distribution are still some disadvantages which must be taken into consideration. Questions of proper distribution in the soil need further study. Comparative yield data show that excellent yields of crops may be expected. Where less than 500 pounds of fertilizer are applied, the solution method has no equal.

### Applying Nitrogen

A common practice is to apply nitrogenous fertilizers for side-dressings. They have their place but generally speaking are unnecessary. It is a better practice to apply nitrogen with the mixed fertilizer deep in the soil. During the growing season the general movement of nitrogen and potash is toward the surface inch of soil. Only in wet seasons do surface applications of nitrogenous fertilizers give efficient results. In dry weather much of the applied material is wasted.

Spraying foliage with light and frequent applications of nitrogenous fertilizer has been successful on some crops. Upon further investigation this may prove to be an efficient method of applying extra nitrogen to crop plants. It would eliminate the hazards of salt concentration in dry seasons.

In summarizing this discussion, one might ask, "What is the poor farmer going to do?" It would seem that regardless of his location, he must find out for himself whether his soil is properly aerated. If his crops make free root growth to depths of three or four feet, his problem is not so serious. If the roots are mostly in the plowed layer, he certainly should use some liming material, the amount to be determined by test plots on his farm or calcium readings on his soil based on base exchange studies made by his experiment station staff.

The quantity of fertilizer that he uses must be determined locally. It will depend on how well the soil is limed and aerated, the crop he grows, and where he is located. If not more than 500 pounds of fertilizer are to be used, they might better be applied in solution four to eight inches under the plants with not more than 50 pounds per acre used as a transplanting solution or 100 pounds as a starter solution, directly on the seed as in the case of beans or peas. In the Midwestern States this method has much merit and may apply as much fertilizer as weather conditions will permit the crop to use.

The ratio of nutrients in any case must be determined locally. There is one thing that seems well established. As the lime requirement of the soil becomes satisfied, the potash level must be higher. The phosphate level need not be emphasized. In other words, where a 5-10-5 is being used at the present time, the grower may find that an 8-8-16 or a 10-10-20 in equivalent amounts will increase yields materially.

Where larger quantities of fertilizer are used, a deeper and more general distribution is advisable and broadcasting the fertilizer before the ground is plowed followed with a transplanting or starter solution will probably give as good or better growth than any method that can be used. The only improvement on this would be to apply all the fertilizer in solution. Space does not

permit a detailed discussion of this method.

On acid soils, for the present at least, some form of placement in bands deep in the soil should be used. Plowing two-thirds of the fertilizer under together with 500 to 750 pounds in a band at least four inches deep, may give better results. This depends on the type of soil.

On natural limestone soils, fertilizer should be plowed under if used in any appreciable quantity. When used in small quantities, the solution method of applying fertilizer will give best results regardless of where it is applied.

---

## Hilding Hord—Dairyman

(*From page* 16)

to the rented land. This passage is a large galvanized pipe nearly six feet in diameter running underneath the road, thus eliminating the danger of cows crossing the highway.

Fertilizer practices vary with the crop and with condition of the fields. If more quick growth is needed, an application of some nitrogen fertilizer is the answer, and if large amounts of manure are applied to a field, an application of superphosphate is also part of the program. For grasses Mr. Hord prefers a 7-7-7 fertilizer analysis, but when the clovers have taken over he applies an 0-14-14 mixture. The amount per acre varies with the crop and condition of said crop, but an average application of 600 pounds per acre is followed very closely.

Mr. Hord is very prominent in all agricultural activities in his community, and holds positions on state committees. He also is a member of civic club, chamber of commerce, church, and several dairy associations. Like all business men he has worries, and when they get rather heavy he retires to his "office," removes his Stainor violin from its case, and eases his mind and spirit with not only classic music but old-time melodies and improvisations which are more of a solace to him than any printed music.

---

## How to Start White Dutch Clover Pastures in Florida

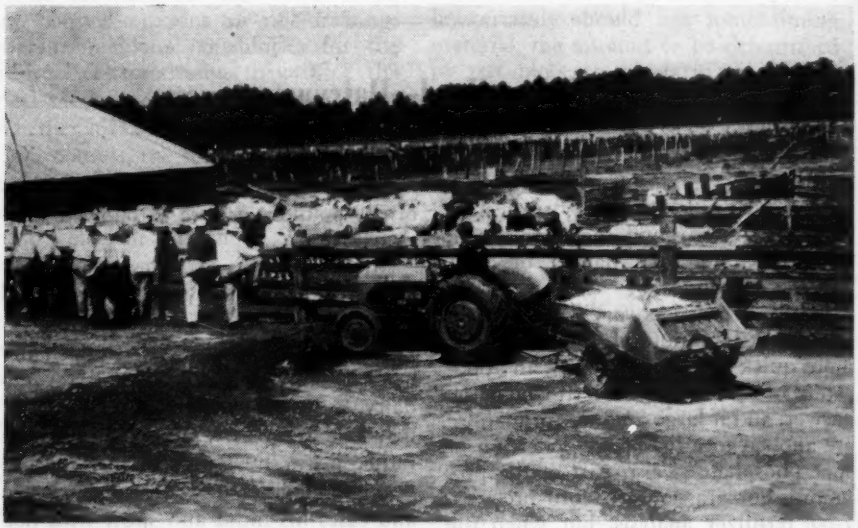
(*From page* 20)

followed by seed. The clover growth the first season by following this practice is shown in Figure 3. With this method it is necessary to mow or chop planted pastures several times a year to control native vegetation. Mowers give better control than choppers, but the areas are usually too rough for the mowing machines to operate the first year.

In 1937 a clover experiment to study nutrient requirements and soil preparation was set up on the Carlton farm. The soil was a Bladen fine sand, and the vegetation was primarily wiregrass. The wiregrass was grazed heavily with dairy cows and also was mowed. Lime and fertilizers and seed were surface applied without soil preparation, and strips were thoroughly disked and subsequently seeded. The growth and stands of clover were very good on plots treated with manure, $P_2O_5$, $K_2O$, and lime, and growth was better where the clover was planted on wiregrass without disturbing the soil than where it was incorporated. One year's data are not sufficient for research purposes,

but proved all the evidence Mr. Carlton needed. On the basis of these results he worked out a rather ingenious method for establishing clover pastures at low costs.

Many carloads of finely ground high calcic lime were dumped in the "hold-up" pens at his dairy farm. The manure is scraped in piles along with some lime and loaded on a manure spreader and 0-14-10 is spread over the top of the manure. This mixture of lime, manure, 0-14-10, and seed is thus applied in one operation, Figure 4. Mr. Carlton has several hundred acres of White Dutch clover-carpet grass pas-



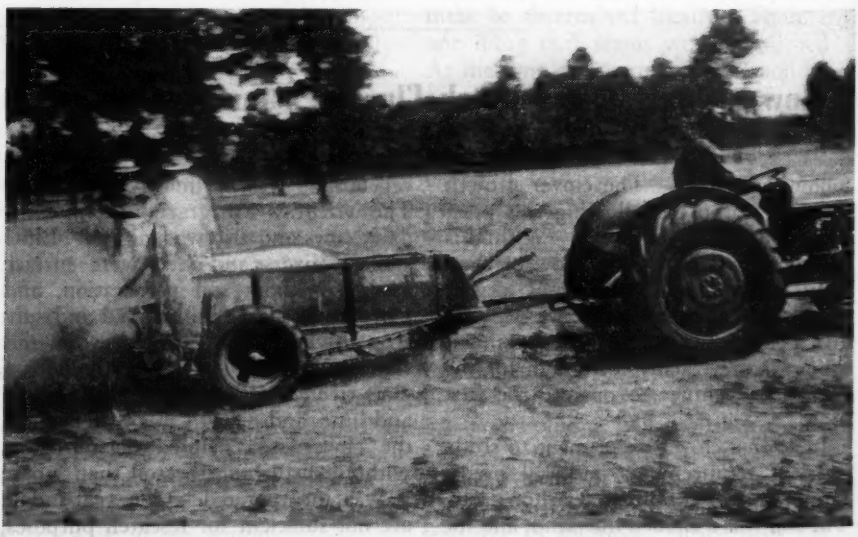


**Fig. 4. A simple way to start pastures. Above: Lime-manure mixture is loaded on spreader and 0-14-10 fertilizer is spread over top of load. The cows grazed clover and carpet grass, thus manure is well supplied with seed. Below: This mixture is applied in one operation on established grass or wiregrass pastures without soil preparation.**

**Fig. 5. Carpet-clover pasture two years after planting on wiregrass by method shown in Figure 4. Photograph made in June after peak growth period of clover.**

ture, making the manure well supplied with grass and clover seed.

With this scheme Mr. Carlton plants pastures during the entire season as the manure in yards is scraped up at about bi-weekly intervals. The manure and minerals applied during the summer months stimulate rapid seedling growth and the clover seed germinate in the fall of the year for the next year's clover crop. This mixture is used on carpet grass pastures and also on closely grazed or mowed wiregrass pastures.

A clover pasture established with this technique is shown in Figure 5. The luxuriant growth can be noted.

---

## A Layout for Labor-saving

(*From page* 17)

were ready to roll, I got the high sign from Wilbur over the long-distance phone. The show staged that day was a demonstration of manure management which strikes a new chord for future soil building.

No wonder there is intense interest in the tractor manure loader. A steel plate bolted to the underside of Renk's power manure fork transforms it into a giant scoop shovel that had a third of the 100 x 100 concrete feet yard scraped clean before I could get my camera set up.

Then it nosed inside the concrete-walled cattle shed thru 11-foot-high doors, and in three bites had a spreader full. Not a pitchfork nor a shovel in sight, yet before the slick-haired, lazy Herefords woke up to what was happening, the shed "floor" had dropped three feet. The winter's accumulation of manure that had elevated them nearly to the ceiling (and kept them warm underfoot) was out on the field and plowed under before the ammonia could evaporate or leach away.

Ammonia, of course, is $NH_3$, nitro-

gen and hydrogen. Loss of it thru leaching, when a manure pile lies exposed to the weather, bothers the conscience of any good husbandman. Not so well known is the fact that ammonia evaporates when manure lies all winter on frozen ground. One-third or more of the nitrogen often escapes into thin air, say University of Wisconsin soil chemists. The fertility-wise Renks stop ammonia loss on both counts by storing up manure in a savings bank—the cattle shed.

The shed and concrete feeding floor combined serve the same as a manure pit, with every corner accessible to the tractor loader. Nothing can get away. Occasional scraping with the tractor cleans the yard. Otherwise, manure chores are forgotten until spring!

Actually, the Renk philosophy is to manufacture manure with highly potent fertility, rather than consider it merely a by-product. To illustrate: they grind up 190 tons of waste corncobs for bedding. Not only are the ground cobs an excellent absorbent, but manure acids hasten their decomposition and increase their fertility value.

The real story in Renks' mechanized feeding system *is* fertility. How they manage to keep up the land and take *two tons* of meat and grain off every acre every year . . . well . . . let Walter give you the answer:

"We made a study of manure and learned that half-strength stuff couldn't do the job.

"We conserve the manure carefully, without a lot of shoveling over. That's the first step. Then comes commercial fertilizer to balance the nitrogen with phosphorus, potash, and lime. Our ground is all limed for legumes. Plus that, we give the land a real shot in the arm with 8-8-8 fertilizer applied by a plow-sole attachment, 300 to 500 pounds per acre. On top of that, 125 pounds per acre of 3-12-12 as a planter side-dressing. Grain gets a good feed of 0-12-10 when it is drilled.

"Results in bigger yields are obvious, but we've discovered something else. Crops are higher in protein and mineral content. It shows up noticeably in feeding. The corn puts on a faster finish. There's so much lime and mineral in our alfalfa and grass silage that they satisfy all the ration mineral requirements."

Can it be that food grown on land supercharged with manure and minerals might stimulate human health as well? Wm. F. Renk wonders as he adjusts his gold-rimmed specs and examines a palmful of dirt. His three boys may have started something when they designed the mechanized barn to manufacture fertility as well as food.

---

## Soil Conservation—More Plant Food—Better Crops

*(From page 26)*

By establishing adequate acreage of permanent improved pastures and providing seasonal supplemental grazing by planting such crops as sudan, small grain, ryegrass, sericea lespedeza, or kudzu, good nutritious feed can be made available for livestock at most all periods of the year. The seasonal pasture plants afford protection against soil loss and are soil-improving when properly managed.

It often takes from $10 to $25 or more per acre to establish a good pasture; however, soil conservation district cooperators have found that this is a profitable investment, in that soil is conserved and improved, and economic returns are greatly increased. In many instances annual applications of potash and phosphorus need to be made. On soils needing lime, time of applications will vary from 5 to 10 years.

## Reform Wave Due

(*From page* 5)

mollycoddling and bamboozling the farmer, I now appear in the role of prosecuting attorney against anybody who dares to do either. I have been guilty as anyone when it comes to soft-soaping and betraying the farmer as a class, while at the same time enjoying his warm hospitality and hot chicken dumplings.

BUT my role in that line has been an indifferent one of small potatoes compared with the ones who sit in the seats of the mighty. I speak of the guys who get votes on agrarian platforms and then get no closer to the soil afterwards than to imbibe a snootful of rye and corn. They love to shake hands with the hay-shakers just before they pass the ballot box around, and make long speeches full of statistics some ghost writer gleaned from the annual report of the Bureau of Agricultural Economics and handed them to read at the rural rally.

Sometimes inadvertently these campaigners have a come-back. For instance, like the dairy ticket spellbinder who garnered votes on the slogan "Down with Oleo." After four years of scarce butterfat he can step up and say with truth that he accomplished his goal—because consumers have indeed made good and put down lots of oleo. The appeal of such caterwaulers is normally aimed at local prejudice wounded on the blind side by some overpowering economic trend which all law-makers in Hades couldn't prevent.

Therefore, I call for a genuine rock-ribbed reform in the ways and means of discusison with agriculture in the mass. Do I hear any response? I count the Ayes and Nays and the Ayes have it.

Maybe there are certain reforms we might indulge in anent the practices of extension campaigners too, but I must shelter my old friends from censure and calumny. Their mistakes are of the head rather than the heart and will bear a slow but sure system of overhauling.

With years of constant travel among country hamlets behind me, the thought comes that our civic clubs and farm organizations presiding over the destinies of such spots might well take vows to make such settlements reflect the beauty and desirability of rural life. Too often upon entering the boundaries of a country trading and service settlement there is a drab and neglected atmosphere presented to view. All the accumulated castoffs of farm repairs and the waste products of living are scattered to the four winds, buildings lack paint and streets are unkempt and cheerless. From the post-office each day the rural delivery crew starts off loaded with fresh batches of suggestions and admonitions and directives issued to instill improvement and beauty hints for owners of adjacent farmsteads. In the village pulpit the minister voices a message of hope for the hereafter, which too frequently seems to postpone all joy to some future period when labor has been fulfilled.

MANY a town on many a winding river amid natural bowers of rustic charm has an abrupt contradictory ending as one crosses the rattling bridge to enter the decadent town. If the rural hamlet is to retain its leadership and serve as inspiration to dwellers on near-by farms, some organized effort must be engaged in by men of good will to make the farmer's visit something more than a change of overalls or a vulcanizing job. I don't think we can continue to talk uplift and sounder thinking and more education to certain elements of the rural population most in need of it as long as we given them nothing but shoddy squalor to look at when they visit the trading center or the bank.

Plenty of towns have done it. Others have tried it and quit, while too many have left all esthetic things untouched and centered their efforts on band concerts and auction days regardless of littered streets and dingy store fronts, and

minus flower beds or quiet restrooms or fountains.

I THINK we have a job to do also in figuring out how far we can safely carry that old competitive spirit into the realm of unmitigated and open warfare, which some call "rivalry," to avoid the truth. We haven't any atomic bomb threat to deter us from a reasonably peaceful home front, as we claim to have in the field of international relations. But we do have common objectives aimed at general welfare which a too keen and insistent rivalry between a multiplicity of organizations tends to frustrate.

You can take the ordinary livestock breeding associations as a handy example. Here a reasonable amount of competition and a friendly American give and take are desirable, but there have been instances of destructive warfare even in these peaceful pursuits which have helped neither side to maintain lasting advantage.

And when it comes to annual conventions and the ringing resolutions issued from such conclaves, maybe there's a little wholesome improvement we can instigate for post-war conversion. During "ODT" restriction days we went without most of these business sessions and the sun still rises and sets on a bigger and better America with expansion profound and vast. Of course some hotels may have missed a few customers (though I doubt it) and a few truckloads of potables went untapped, but the mail-order system of holding conventions has had its merits. Similarly if we can exert some reform on the members so they will heed the reading of the resolutions and put a few of them into practice, it might put a better face on things.

To many conventions of farm marketing co-ops, the dear feminine contingent goes along to enjoy the privilege of shopping and putting on avoirdupois unashamed at the banquet diversions. My hunch is that they should be put to work. They could add a good measure of repartee to the sessions of the resolutions committee and many of them would be as capable of presiding with a firm hand and voicing strong opinions on the platform as they invariably are at home. If the farm is dedicated to the family, then it is high time that farm economic programs have the same goal.

THEN we come to the important postwar objective of centralizing the farm committees, action agencies, and the extension forces in one county stronghold—a sort of bucolic bastion of unity and joint assembly, instead of having the various and sundry groups all groping around the county to locate the services they need. Instead of obliging a farmer to take a day off to transact his business because of needless mileage to cover, we might copy the slogan of the corner gas and automotive station, and get it all done "in one stop."

These county agricultural temples will spring up fast in the next ten years. It's in the wind, and blowing strong. One good plan might be to establish a statewide contest among architects and builders to attract talent to the designing of the most serviceable and decorative and modern agricultural center.

Maybe with such a common meeting place some of the disdain and aloofness existing between organizations mutually dedicated to better farm life would rub off for keeps. We'd find after all that there are more points on which we agree than there are angles to battle about. It might also erase the harmful effects of too much partisan influence, like one party taking sides with the Farm Bureau, for example, and the other party lining up for the Grange or the Union, etc. It may seem like taking in too much territory to expect rival farm organizations to fraternize in one hall, but it *could* be done. And if it isn't *ever* done, what hope can we have of keeping peace with Russia or some other distant land with another language?

It would be a good time too to begin a crusade in the open country against repetition of the noxious forms of poster and painted display advertising which has been so long an eyesore to lovers of

our native landscape. It is bad enough to be obliged to listen to more than necessary radio commercials without having their zeal for victims thrust upon us from every rock, tree, and silo along the rural lanes. In this I should have the hearty support of the successful advertising agencies themselves, because they share but little in the graft entailed in smearing the borderlands. You may say it is entirely within the private rights of a yokel to let some billboard dauber slobber oceans of violent colors on his barns and silos for a pitiful royalty and maybe a carton of cigarettes. But if he *has* to discolor his outbuildings let's sic the cooperatives on him so he will display real agricultural wares instead of eating tobacco, pilsener, or old crow.

IF I continued in this vein I might swing wide and handsomely against mothers-in-law, divorces, fake-ridden fairs, bum side-road conditions, cheap seeds, cure-all stock remedies, and newspapers in country towns which prefer stock-market reports and Walter Winchell to a supporting program for agriculture. But I have no intention of being branded as a blue-nosed Corrector of Conditions. I also am too engrossed in thinking up another topic to spend time seeing that these reforms are carried out. Yet I do sincerely feel that before we risk our fortunes and our energies on distant misdemeanors or try to revoke the customs of some other country, we can get a lot of valuable practice at home. Verily the war deprived us of some things which we might well stand deprived of for some time to come.

## Outline of Romance

Dear Mr. Carmichael.
Dear Bill.
Bill Dear.
Dearest Bill.
You Wonderful Guy.
My Own Own Sweetheart.
You Wonderful Guy.
Dearest Bill.
Bill Dear.
Dear Bill.
Dear Mr. Carmichael.

**LaMOTTE OUTFIT for determining Available Phosphorus**

This outfit represents the most recent development in determining available phosphorus in soil and gives the result in pounds per acre. A test can be accurately made in five minutes. Complete with LaMotte Soil Handbook. Price $12.50 F.O.B., Towson, Baltimore, Maryland.

• • • •

**LaMOTTE MORGAN SOIL TESTING OUTFIT**

This outfit makes it a simple matter to determine accurately the pH value or to know "How acid or how alkaline" your soil is. It can be used on soils of any texture or moisture content except heavy clay soil. Complete with LaMotte Soil Handbook. Price $10.00 F.O.B., Baltimore, Md.

• • • •

Information about the full series of LaMotte Soil Testing Equipment will be sent on request.

• • • •

**LaMotte Chemical Products Co.**
Dept. BC,
Towson 4, Baltimore, Md.

## AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

### Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

### Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
S-6-42 A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa
FF-11-42 Boron in Agriculture
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not a Poor Land Crop
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
BB-6-43 Sericea Is A Good Crop
FF-8-43 Potash for Citrus Crops in California
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production
A-1-44 What's in That Fertilizer Bag?
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
K-3-44 Soil Tests Indicate Potash Levels
L-3-44 South Finds Clovers Excel in Profits
P-4-44 Borax Sprayed on Beets Controls Black Spot
R-5-44 More About Soybean Fertilization
T-5-44 Southern Crops Show Need of Potash
W-6-44 Fertilizer Requirements for Permanent Pastures in Alabama
X-6-44 Soil Management for Cannery Peas
Y-6-44 Sweet Clover Responds to Potash Fertilizer
Z-6-44 Our Fertilizers Need Magnesium
AA-8-44 Florida Knows How to Fertilize Citrus
CC-8-44 Soil Fertility's Effect on Asparagus
DD-8-44 Keeping Soil Fertile in the Pecan Orchard
KK-11-44 Growing Quality in Tomatoes
MM-12-44 Blue Lupine Is a Valuable Legume
PP-12-44 Fitting Practices to Soil Conditions
QQ-12-44 Leaf Analysis—A Guide to Better Crops
A-1-45 Fertilized Corn Plants Require Well-Ventilated Soils
C-1-45 Fertilizers for Cotton and Corn Following Lespedeza
E-1-45 Bigger Yields from Fertilizers
F-2-45 Defective Strawberry Fruit Corrected by Borax
G-2-45 Some Whys and Wherefores for Air-Conditioning Soils
I-2-45 Crop Fertilization or Rotation Fertilization
J-2-45 Potash for Legume Pastures in Florida
K-2-45 Plow-Sole Fertilizing on the Average Farm
L-2-45 Fish for Health, Recreation, and Politics
M-3-45 Potassium—A Key Element
N-3-45 The Rutabaga Crop in Virginia Is Benefited by Boron
O-3-45 Using Poultry Manure for Garden Compost
P-3-45 Balanced Fertility in the Orchard
Q-3-45 Earliness Counts with Austrian Winter Peas
R-3-45 Higher Corn Yields for North Carolina
S-3-45 Alfalfa Production on the Sand Mountain of Alabama
U-4-45 New Ideas in Haymaking from New York Farmers
V-4-45 Yield and Quality of Cotton Can Be Improved by Boron
W-4-45 Fertilizing Golf Greens
X-4-45 Idle Acres in the Southeast Can Be Put to Work
Y-5-45 How Long Do the Effects from Fertilizer Last?
Z-5-45 Alfalfa—the Aristocrat
AA-5-45 Why Brown Loam Terrace Soils Respond to Potash
BB-5-45 Applying Experimental Work to Cotton Farming
CC-5-45 Cason Callaway Plans Ahead for Georgia's Agriculture
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
EE-6-45 Balanced Sods in Orchards
FF-6-45 Orcharding from the Ground Up
GG-6-45 Know Your Soil
HH-6-45 Boron Content of Mississippi Soils and Plants
II-6-45 Selective Service for Each Acre

**THE AMERICAN POTASH INSTITUTE**

**1155 16TH STREET, N. W. WASHINGTON 6, D. C.**

*Have You seen the Motion Picture*

# PLANT FOOD FROM COAL

● MILLIONS of years ago, prehistoric forests gathered Nitrogen as they grew. Today this Nitrogen is recovered from coal by modern coke and gas plants as Sulphate of Ammonia. The manufacture of coke-oven *Domestic* Sulphate of Ammonia and its use as a plantfood are graphically portrayed in the 16 mm. sound and color motion picture "Plant Food from Coal," running time 39 minutes. This film is loaned free for educational use. Send your request to the address below. Specifiy dates and alternate dates film is desired.

**COKE OVEN AMMONIA RESEARCH BUREAU**

**50 West Broad Street, Columbus 15, Ohio**

***Free!*** **This handsomely-illustrated 24-page booklet is based on the film and is filled with full-color pictures taken from the film.** ***It is yours for the asking!***

A man from a small town attending a convention in a big city, took in a show which featured the display of the maidenly form to a greater extent than that to which he was accustomed, and the next day he was obliged to go to an oculist to have his eyes examined.

"After I left the show last night," he explained, "my eyes were red and inflamed and sore."

The oculist examined his eyes, thought a moment and then remarked, "After this, try blinking your eyes once or twice during the show; you won't miss much."

---

OBSERVANT

"Why did you leave your girl's house so early?"

"Well, we were on the sofa and she turned out the light. I guess I can take a hint."

---

Clothes make the man; with a woman, however, they just serve to show how she's made.

---

Two little girls were comparing progress in catechism study. "I've got to original sin," said one. "How far have you got?"

Said the other: "Oh, I'm way beyond redemption."

---

"Now that I've told you about my past, do you want to marry me?"

"Sure, baby."

"I suppose you'll expect me to live it down?"

"No! I'll expect you to live up to it."

AT 2:15 A. M.

"Hello, is this Thorndyke 5624?"

"Mffp, Snf—er, ho hum. No, you got the wrong number."

"Oh, I'm sorry."

"Tha's all right. I hadda gittup an' answer the phone anyway."

---

Negro (to another)—I see a man can get a wife over in China fo' about foah dollars.

Other Negro—Man that's foolishment! Wha' foah a man want a wife effen he got foah dollars?

---

Not one man in a million knows or cares how he looks from the rear.

---

A group of soldiers' wives were bragging about their husbands. The first remarked that at last hers had been granted a commission.

"Bill has just got notice of his captaincy!" thrilled the second.

The third hinted that her husband was hoping for his first lieutenancy that month.

In a brief pause the fourth bride burst out bravely, "Well, Johnny still has his privacy, anyway!"

---

TALE OF TWO RABBITS

Two rabbits got lost in the woods and had a hare-raising experience.

---

"A single salmon," declared the pretty young teacher, "produces in one season 20,000 young."

"Teacher," cried little Evelyn, "how many young does a married salmon produce?"

*Need for—*

# BORON IN AGRICULTURE

**Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.**

**Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.**

**The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.**

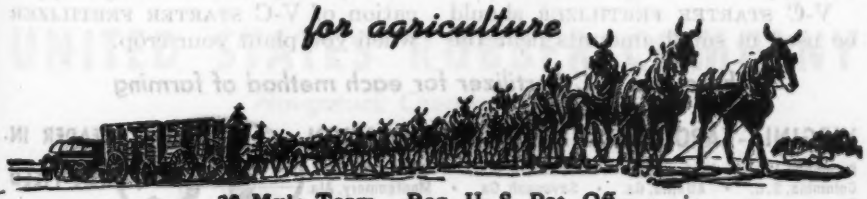
**Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.**

## PACIFIC COAST BORAX COMPANY

**NEW YORK CHICAGO LOS ANGELES**

# BORAX

*for agriculture*



**20 Mule Team. Reg. U. S. Pat. Off.**

# How to lead crops to water ...and make them drink food

V-C PLOW-SOLE FERTILIZERS are designed for the new method of applying plantfood at the bottom of the furrow directly on the plow-sole, out of reach of surface weeds.

V-C PLOW-SOLE FERTILIZER encourages plant roots to go down deep and find plantfoods where soil water is most abundant. The combination of V-C soluble plantfoods and subsurface water produces bigger yields. A heavy application of V-C PLOW-SOLE FERTILIZER keeps on feeding crops through the season, even during periods of dry weather.

V-C STARTER FERTILIZER should be used in small amounts near the surface for early growth. V-C PLOW-SOLE FERTILIZER should be used in a heavy application, down deep in moist soil, for later growth and maturity.

Three important points to remember about plow-sole application of fertilizer are: (1) Use it only for deep-rooted crops, (2) Use a heavy application, (3) Use an analysis, especially designed for this purpose, such as V-C PLOW-SOLE FERTILIZER.

Use a heavy application of V-C PLOW-SOLE FERTILIZER when you break your ground and a light application of V-C STARTER FERTILIZER when you plant your crop.

***There is a V-C Fertilizer for each method of farming***

**VIRGINIA-CAROLINA CHEMICAL CORPORATION**

Richmond, Va. • Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C.
Columbia, S. C. • Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala.
Birmingham, Ala • Jackson, Miss. • Memphis, Tenn. • Shreveport, La.
Orlando, Fla. • E. St. Louis, Ill. • Baltimore, Md. • Carteret, N. J. • Cincinnati, O.

VC FERTILIZERS

LEADER IN THE FIELD SINCE 1895

# Useful Information for the Busy County Agent

Today the County Agent is guide and mentor to millions. His job of helping farmers grow better crops has taken on new proportions. Now he is directly responsible for the success of Victory Gardeners who are doing so much to increase America's food supply.

One subject on which the County Agent wants to be well-informed is the protection of seed against soil-borne and seed-surface fungi. Seed protection is important in any season—and is especially important in a cold, wet planting season like the one just past.

Write today for latest reports on the use of Spergon to protect seed; increase emergence; stimulate growth; improve stands and yields. Information about this non-injurious, easy-to-use seed treatment deserves a place in your working library.

### *Advantages of* Spergon

- Safe to use—cannot harm delicate seeds, even when used in excess.
- Safe for user—non-poisonous and non-irritating to those applying it to seed.
- Long lasting—Spergon does not deteriorate with age; may be applied months in advance of planting.
- Self-lubricating. No graphite needed in drill.
- Compatible with legume inoculants.

### TYPICAL DOSAGES

| | |
|---|---|
| Corn | 1½ oz. per bu. seed |
| Peas | 2 oz. per bu. seed |
| Beans (including Limas) | 2 oz. per bu. seed |
| Soybeans | 2 oz. per bu. seed |
| Sorghum | 1½ oz. per bu. seed |
| Flax | 2 oz. per bu. seed |
| Peanuts | 3 oz. per 100 lbs. seed |

## Spergon

Reg. U. S. Pat. Off.

**SEED PROTECTANT**

## UNITED STATES RUBBER COMPANY

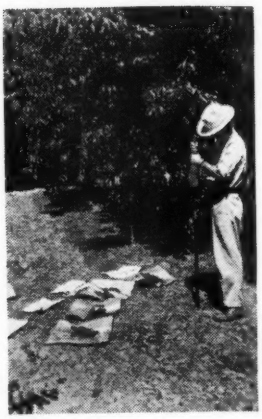
*Naugatuck Chemical Division*

1230 Sixth Avenue • Rockefeller Center • New York 20, N. Y.

*Serving Through Science*

# THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:



**THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS** pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

**THE PLANT SPEAKS, SOIL TESTS TELL US WHY** depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

**THE PLANT SPEAKS THRU TISSUE TESTS** shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

**THE PLANT SPEAKS THRU LEAF ANALYSIS** evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

**American Potash Institute**
1155 Sixteenth Street
Washington 6, D. C.

Printed in U. S. A.